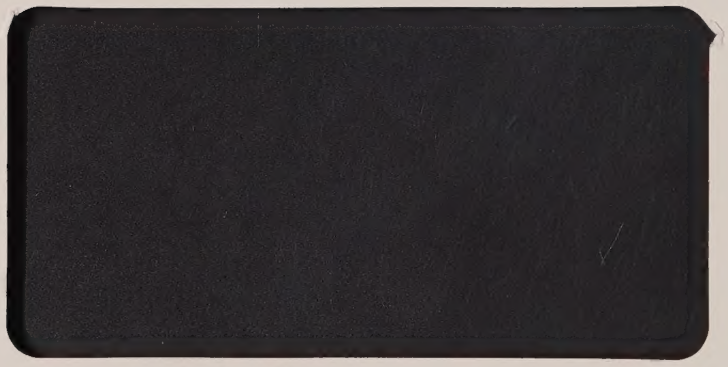
VIBRATION TEST EQUIPMENT

VIBRATION CONTROL SYSTEM

MODEL 400AT/S

SINUSOIDAL VIBRATION TESTING

UNHOLTZ-DICKIE CORPORATION



VIBRATION CONTROL SYSTEM

MODEL 400AT/S

SINUSOIDAL VIBRATION TESTING

Revision 10/20/89

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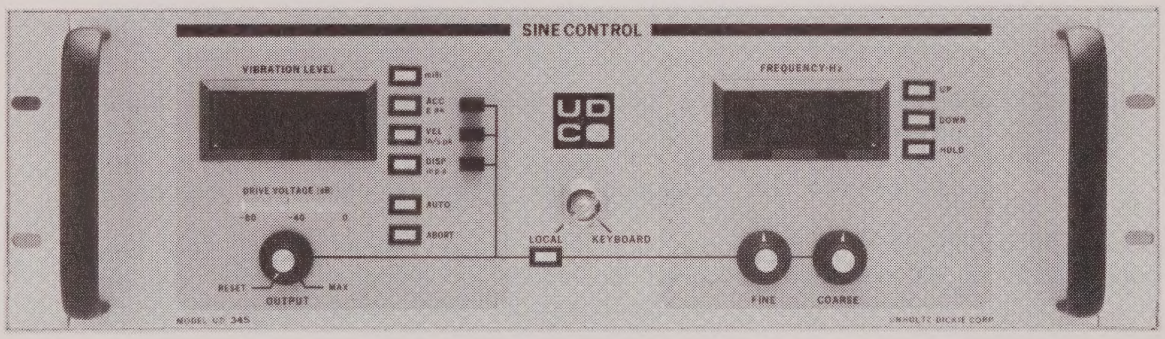
The Heart of the 400AT/S

Vibration Control System



Model UD345 SINE CONTROL

UNHOLTZ-DICKIE END USER LICENSE AGREEMENT FOR THE DIGITAL VIBRATION CONTROL PROGRAM

Prior to using this Unholtz-Dickie digital vibration control product, you should review the following UNHOLTZ-DICKIE End User License Agreement.

The computer program is provided on the condition that the End User agrees to the following at the time of receiving the program.

1 - The UNHOLTZ-DICKIE vibration control computer program and manual are protected by copyright laws.

2 - When the End User receives the vibration control computer program, the acceptance of the program acts as a license to use the program. This license may be revoked at any time by UNHOLTZ-DICKIE if the End User is found to be in breach of the copyright laws or any part of this Agreement.

3 - This license allows the End User to use and display the program on a single computer. You may physically transfer the program from one computer to another provided that the program is used on only one computer at a time.

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6 - The program is licensed only to you, the End User, and may not be transferred to anyone without the prior written consent of UNHOLTZ-DICKIE.

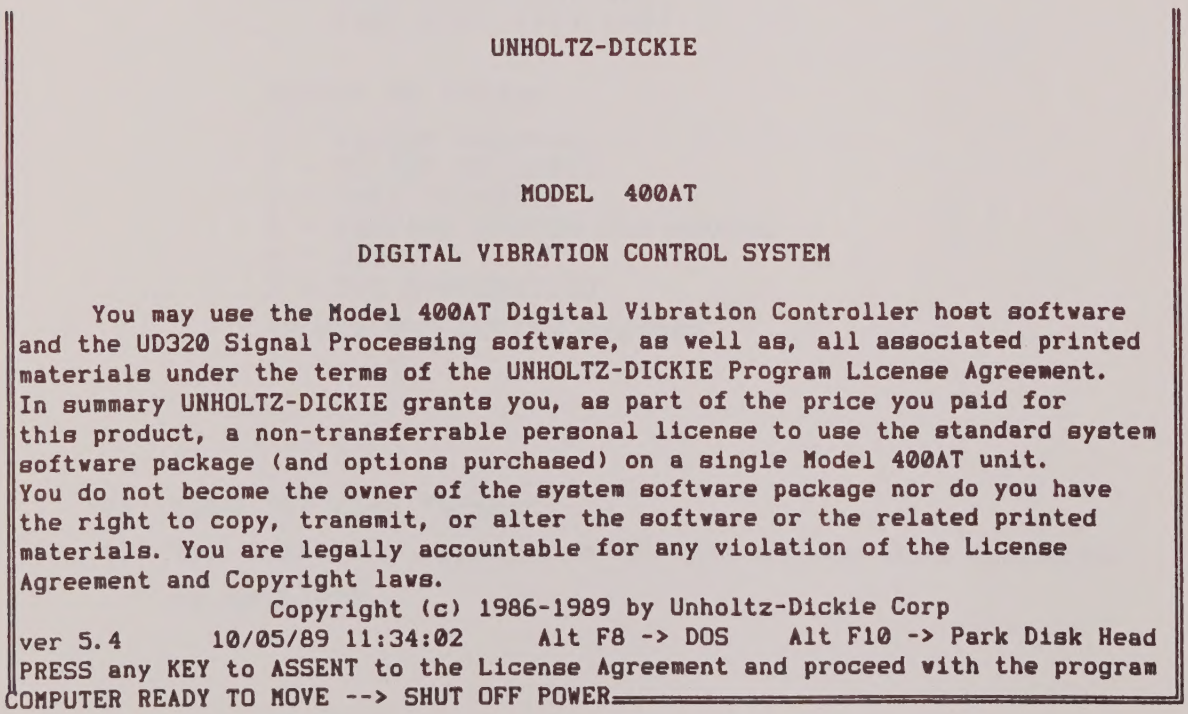
7 - This license is effective until terminated. This license will terminate automatically without notice from UNHOLTZ-DICKIE if you fail to comply with any provision of this license. Upon termination, you shall destroy the written materials and all copies of the program.

8 - UNHOLTZ-DICKIE may create updated versions of the program. At its option, UNHOLTZ-DICKIE will make such updates available to the End User. A fee may be charged for such updates.

---------- IMPORTANT ----------

THE HEAD OF THE HARD DISK MUST BE PARKED OFF THE DISK BEFORE MOVING THE SYSTEM. DAMAGE TO THE UNIT MAY OCCUR IF THIS IS NOT DONE. TO PARK THE HEAD, FOLLOW THE INSTRUCTIONS BELOW.

1. Turn the AC power on.
2. Go to the UD Title Page for the 400AT System ,
3. Press the (Alt) and (F10) keys simultaneously.
4. After a short interval, the Title Page appears as below with the addition at the bottom, "COMPUTER READY TO MOVE --> SHUT OFF POWER".


UNHOLTZ-DICKIE
MODEL 400AT
DIGITAL VIBRATION CONTROL SYSTEM
You may use the Model 400AT Digital Vibration Controller host software and the UD320 Signal Processing software, as well as, all associated printed materials under the terms of the UNHOLTZ-DICKIE Program License Agreement. In summary UNHOLTZ-DICKIE grants you, as part of the price you paid for this product, a non-transferrable personal license to use the standard system software package (and options purchased) on a single Model 400AT unit. You do not become the owner of the system software package nor do you have the right to copy, transmit, or alter the software or the related printed materials. You are legally accountable for any violation of the License Agreement and Copyright laws.
Copyright (c) 1986-1989 by Unholtz-Dickie Corp
ver 5.4 10/05/89 11:34:02 Alt F8 -> DOS Alt F10 -> Park Disk Head
PRESS any KEY to ASSENT to the License Agreement and proceed with the program
COMPUTER READY TO MOVE --> SHUT OFF POWER

5. The computer should be insensitive to further keyboard commands. TURN THE AC POWER OFF.
6. Insert the protective cardboard diskette into the Floppy Drive.
7. The System may now be moved safely.

IMPORTANT

ALTERNATE METHOD TO PARK THE HARD DISK HEAD.

PARK THE HEAD OF THE FIXED DISK BEFORE MOVING THE SYSTEM TO PREVENT DAMAGE TO THE HARD DISK.

1) Insert the IBM diagnostics diskette.
2) Turn PC AT AC power OFF, then back ON.
3) After approximately thirty seconds the following appears on the CRT screen.

```
The IBM Personal Computer
ADVANCED DIAGNOSTICS
Version 1.02
(C) Copyright IBM Corp.
    1981,1982,1983,1984

SELECT AN OPTION

0 - SYSTEM CHECKOUT
1 - FORMAT DISKETTE
2 - COPY DISKETTE
3 - PREPARE SYSTEM FOR MOVING
4 - SETUP
9 - END DIAGNOSTICS

SELECT THE ACTION DESIRED
?
```

4) Type "3" then "Enter"
5) The following appears on the CRT screen when operation is complete.

```
DRIVE C
IS PREPARED FOR MOVING
TURN SYSTEM OFF
?
```

6) Remove diagnostic diskette and turn power OFF.
   Insert the protective cardboard diskette.

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4	PERFORMING THE SINE VIBRATION TEST
5	SAVING AND RETRIEVING DATA
6	COPYING OPERATIONS
7	CHECKOUT - CALIBRATION
8	CIRCUIT SCHEMATICS - LAYOUTS
9	RESONANT DWELL TESTING (OPTION)
10	CIRCUIT DESCRIPTION

1. SYSTEM OVERVIEW AND THEORY OF OPERATION

1.1 General System Description and Objectives

The UD Model 400AT/S Vibration Control System (VCS) is used in conjunction with a vibration test system (VTS), consisting of a power amplifier, test specimen, accelerometers and signal conditioners. For swept-sinusoidal vibration testing, it provides computer control for the signal generation, level regulation measurement and documentation necessary to perform a complete test.

The 400AT/S provides the means to:

1 - Specify the various test parameters and to initiate the test through keyboard entry.

2 - Acquire the accelerometer input signal(s) from the charge amplifier(s).

3 - Execute the test in a completely automatic mode which may be overridden.

4 - Monitor the test by means of real-time test graph displays and status messages.

5 - Perform error checking and provide quick and transient-free shutdown when abort conditions exist.

6 - Allow additional channels for average control and/or independent channel frequency response analysis.

7 - Store and provide hard copy for test setup parameters and test data.

1.2 System Configuration

The block diagram of the UD Model 400AT/S in conjunction with a typical vibration test system is shown in Figure 1-1. The VCS consists of a System Host with a MetraByte DASCON 1 Card and the UD345 SINE CONTROL. Commands and data flow between the DASCON 1 in the System Host and the UD345. The System Host also provides an external interface for remote control of the VCS.

The UD345 provides the drive voltage for the power amplifier. When the average control option is supplied, it accepts as many as eight input signals which represent the accelerations at various points on the test specimen. All eight inputs may be selectively multiplexed for average control. Also, any one of the eight inputs, regardless of its use as a control input, may be selected for analysis purposes only.

The simplest configuration for the UD345 provides one input for control use only. The analysis option provides a single input for control purposes and an additional input for analysis only.

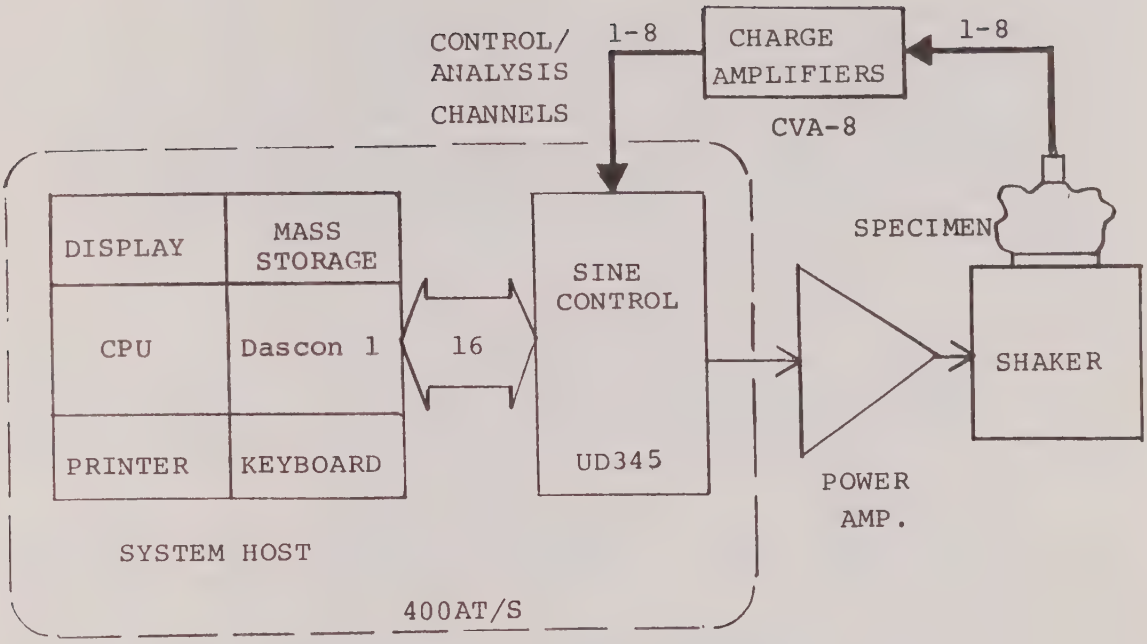


Fig. 1-1

Block Diagram - Vibration Test System with 400AT/S

1.3 UD345 Signal Flow

Figure 1-2 shows further details of signal flow associated with the UD345. The eight possible control/analysis inputs are shown, along with the drive voltage output from the UD345.

The UD345 has four major sections: the sweep oscillator, the automatic gain control (AGC) amplifier, the vibration level programmer and the digital interface for control from the System Host Computer.

The sweep oscillator section digitally generates a constant amplitude sine wave with extremely low harmonic distortion. The frequency may be swept up and down, over any portion of the three-decade frequency range, in a linear or logarithmic fashion, over a wide range of sweep speeds and for a specified number of times. The sinusoidal oscillator signal is the input to the AGC amplifier.

The vibration level programmer section accepts the acceleration input signal(s). A multiplexer provides a composite signal containing one cycle of each input signal in the sequence specified by the operator. The multiplexed signal is used for acceleration

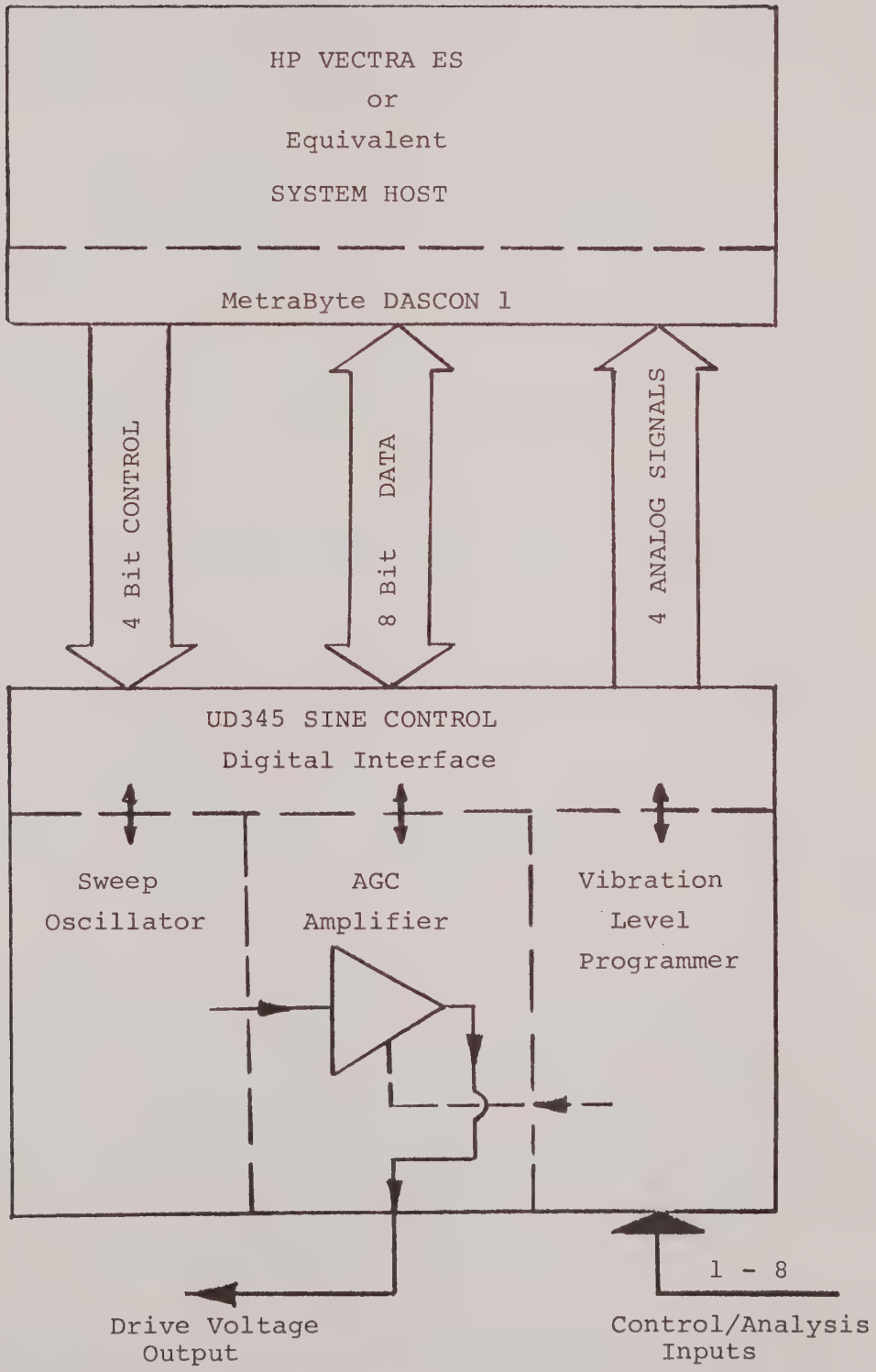


Fig. 1-2 SIGNAL FLOW - UD345 WITH HOST

control segments only, and the first channel specified in the input sequence is used for displacement and velocity control segments.

The programmer can define a control reference for any combination of as many as 60 constant acceleration, velocity and displacement segments with the crossover frequencies being automatically calculated or operator selectable. Reference control levels are possible over the following intervals:

Acceleration:	0.1 to 1000 g - peak
Velocity:	0.1 to 1000 in/s peak
Displacement:	1 mil to 10 in pk - pk

Due to system noise levels, the lower velocity and displacement levels may not be possible at low frequencies.

In providing for the specified control reference segment, the programmer integrates the control signal once for constant velocity segment, and twice for a constant displacement segment. The overall signal level is adjusted to provide the specified control amplitude.

The UD345 also contains a charge amplifier for conditioning one accelerometer signal. The charge sensitivity is manually set by two rear panel controls to provide a conditioned output signal at 10 mV/g.

The AGC amplifier provides a variable gain amplifier for the signal output from the oscillator section. The output from the AGC amplifier is the drive signal for the power amplifier. The AGC amplifier also accepts the modified control signal from the programmer section. The amplitude of the control signal is obtained from an AC-DC converter, the detection speed of which is a controlled function of frequency. The control amplitude is then compared with a fixed reference and any difference causes the gain of the AGC amplifier to change the drive signal level so that the difference of the control signal amplitude and the reference goes to zero.

The detection speed or compressor speed of the AGC amplifier increases with frequency and is selected by the operator. The AGC amplifier also has unique circuitry which provides a drive signal with extremely low harmonic distortion.

The digital control section for the UD345 contains the necessary registers, FET switches and multiplying DACs to provide the functions described previously. Two digital busses provide communication between the Host and the UD345:

CONTROL Bus (4-bit)--- DASCON 1 to UD340
DATA Bus (8-bit)------ Bidirectional

In addition, four analog signals are fed from the UD345 to the DASCON 1 card. They represent control channel vibration level, analysis channel vibration level, drive voltage, and phase (Resonant Dwell option only).

The CONTROL bus provides the following functions for the UD345.

1 - Strobes the address for the various registers.

2 - Initiates crossover from one control segment to the next.

3 - Writes data on the DATA bus.

4 - Reads data on the DATA bus.

The DATA bus provides the following functions:

1 - Sets the significant bits, full-scale range and A-V-D selection for the UD340 reference level.

2 - Sets the sweep rate and selects the sweep type (log or lin.).

3 - Sets the multiplexer channel sequence.

4 - Sets the channel number and the acceleration full scale range for analysis.

5 - Sets the STATUS (operational mode) of the UD345. These include LOCAL or KEYBOARD control, AUTO (closed-loop) control, MANUAL (closed-loop) control, and STANDBY (zero signal) for the AGC amplifier section. SWEEP DIRECTION (up/down), and HOLD (frequency) are set for the oscillator section. The CAL mode automatically disconnects the drive voltage from the power amplifier and feeds it directly to the acceleration input, thus bypassing the VTS.

6 - Reads the STATUS described above.

7 - Reads acceleration full scale range for LOCAL mode operation.

8 - Reads test frequency.

1.4 System Host

A Hewlett-Packard Vectra ES or equivalent machine, based around the 80286 Microprocessor is the System Host. It includes a 20 Mbyte hard disk, a 1.2 Mbyte floppy disk, a 640 Kbyte RAM, a MetraByte DASCON 1 data acquisition and control interface card, a high resolution color display and graphic interface, a 80287 math coprocessor, a dot-matrix printer, a clock calendar with battery backup, a keyboard and the DOS operating system. Primarily the System Host is used to set up, initiate and monitor tests, and also to record and to provide hard copy of test results.

The operator enters the test parameters by means of the keyboard at the System Host in response to a series of simple menus and prompts. The System Host boots directly to the vibration test menu when AC power is applied.

For monitoring tests in progress, the System Host provides continually-updated, fully-annotated, high-quality color graphic displays of the following variables, as functions of frequency.

1 - Control acceleration, reference acceleration and abort limits

2 - Analysis channel acceleration

3 - Drive voltage

4 - Transfer ratio of analysis channel acceleration to control channel acceleration.

Appropriate messages and measurements are also displayed on the borders of the graphical displays. These include peak acceleration, peak velocity, peak-to-peak displacement, frequency, current reference level, duration of the test, time of day, date, maximum compressor speed, test status, sweep number, sweep type, and input control channel sequence.

Single keystroke commands allow the System Host to select and control various test modes. The test variable being displayed and the configuration of the test graphs are also controlled mostly by single keystroke commands.

The hard disk provides storage for hundreds of test setups amd data from hundreds of test runs. Backup and archiving is accomplished with floppy disks.

The high-speed graphics printer provides hard copy of test setups and graphs of test data. The test setups are suitably organized in tabular form for the reference segments and their associated abort limits. The graphs of test data are rotated 90° when printed to provide the same aspect ratio on the 8 1/2 x 11 sheet as is attained on the color monitor, thus maximizing the size of the hard copy graphs.

An optional communications interface is available to provide overall system control from a remote host. Rudimentary commands to start, stop, select a test setup and test mode, and to request status are implemented.

The System Host, aside from the specific function of test control, may also act as a general purpose computer to run any IBM PC AT software and to allow for development of user-specified programs.

1.5 Technical Specifications (UD345 with HD Vectra ES as Host)

FREQUENCY RANGE	- 5 to 5000 Hz Stability $\pm$1% or 0.5 Hz, whichever is larger
SWEEP TYPE	- Logarithmic or linear

MAX SWEEP RATE - 10 octaves/min for log sweep
5000 Hz/min for linear sweep
Minimum Sweep Time, 1 min. (Opt. 0.5 min.)

SWEEP REVERSAL LIMITS- Selectable over entire frequency range

NUMBER OF SWEEPS - 1 to 9999 or continuous

STARTING FREQUENCY - Selectable over entire frequency range

COMPRESSOR SPEED - Automatically controlled as a continuous function of frequency from 10 dB/sec at 5 Hz to a selectable maximum of 100, 300, 1000 or 3000 dB/sec at 5 kHz

DYNAMIC GAIN RANGE - Greater than 80 dB

CORRECTION ACCURACY - Essentially zero static error. 70 dB gain change results in less than 0.1 dB change in test level

REFERENCE - Defined using any combination of up to 60 constant acceleration, velocity and displacement segments. Crossover frequencies automatically calculated or operator selectable.

ABORT LIMITS - Independently settable upper and lower limit in percent for each segment

CONTROL STRATEGY - Single channel peak control standard. Eight channel averaging (optional). Internally multiplexed according to sequence specified. Average control for acceleration segments only. Multichannel Extremal Control (optional). Resonant Dwell Control (optional).

DRIVE VOLTAGE - 9V rms max. Harmonic distortion less than 0.3% from 20-3000 Hz; less than 0.5% from 5-5000 Hz. Output impedance 50 ohm.

ACCELERATION INPUT(S)- 10, 100 or 1000 mV/g conditioned inputs (8) At least 47 kilohm input impedance; charge converter adjustable from 1-100 pc/g input sensitivity, for 10 mV/g output.

TEST STORAGE

Setups - Tests are specified through use of prompts and selection menus. Storage is provided for hundreds of test setups on the hard disk.

Test Data - Test spectra (fully annotated) are stored automatically or as selected by the operator. Storage is provided for hundreds of test spectra. Spectra stored include the control, reference, abort limits, drive voltage, analysis channel and transmissibility ratio.

2. INSTALLATION - INTERCONNECTIONS

2.1 Preliminary

Unpack the separate items carefully, taking care not to damage any items or lose any small items. It would be advantageous to save the shipping containers should any items need to be shipped to the factory during the warranty period.

The following items should be available after unpacking:

(1) UD Model 320 HSDSP (400AT/R, 400AT/T)
(2) UD Model 345 SINE CONTROL (400AT/S only)
(3) Hewlett Packard Vectra ES Host computer or equivalent
(4) Metrabyte Dascon 1 Interface for PC AT (400AT/S only)
(5) Hewlett Packard Video Graphics Color Display
(6) Keyboard for Host Computer
(7) Dot Matrix Printer - Okidata Microline 320 or HP Paintjet
(8) Signal Cable for Printer (25 pin, D connector)
(9) IEEE-488 Signal Cable (400AT/R, 400AT/T)
(10) 37 pin Signal Cable (400AT/S only)
(11) Removable power cords for the Host Computer, Video Monitor, and Printer
(12) Mounting Cabinet or 19" Rack Mount

Before making electrical connections, arrange the various items in the Mounting Cabinet or locate the components in the 19" rack.

For the combined 400AT/R and 400AT/S VCS, see Fig. 2-3 for recommended 19" rack mounting.

2.2 Power Connections

Connect the removable power cords to the UD320, UD345, Host Computer, Video Monitor and Matrix Printer, and plug the other end of each into the line power receptacle (115 VAC) mounted inside the Mounting Cabinet. The user may want to purchase and install a power line surge protector at this point.

The user may also desire to apply power to the 400AT through the vibration power amplifier console, by plugging the line power cord from the common receptacles inside the Mounting Cabinet to a line power receptacle inside the UD system console. This allows line power to be applied when the POWER ON button is pushed on the Power Amplifier Control Panel. This step should be done last however, as a number of signal interconnections still have to be made.

Check the line voltage switches on the rear panels of the UD320, UD345 and the Host Computer, and also the specifications on the rear panels of the printer and Video Monitor to make sure that they agree with the line voltage being supplied (usually 105-125 VAC 50-60 Hz).

2.3 Signal Interconnections -HP Vectra ES Host

Make the following signal interconnections where applicable:

(1) The keyboard is connected to the Host Computer via a cable with a 5 pin circular connector and a mating connection on the rear of the Host Computer. When the pins are appropriately mated, push the connector in about 1/2 inch.

(2) (400AT/R, 400AT/T) The Host Computer is connected to the UD320 HSDSP via the IEEE-488 cable with a 24 pin male ribbon connector on each end. The IEEE-488 port is labeled on the rear panel of the UD320 and is in connector slot 4 on the rear panel of the Host Computer. Tighten the two locking screws on each connector housing after mating.

(3) The integral signal cable on the Video Monitor has a 15 pin (3 row) male D style connector which mates to the connector in slot 2 on the rear of the Host Computer. Tighten the locking screws with a small screwdriver.

(4) The printer cable may or may not be integral with the printer, depending on the printer model. The 25 pin male D style connector mates with the connector in slot 7 on the rear of the Host Computer. Tighten the locking screws with a small screwdriver.

(5) (400AT/S) The Host Computer is connected to the UD345 SINE CONTROL via the cable with a 37 pin D-style female connector on each end. The port on the rear panel of the UD345 is labeled J1 and the corresponding port on the rear of the Host Computer is in connector slot 6. Tighten the two locking screws on each connector housing after mating.

2.4 Signal Interconnections - UD320 HSDSP-UD345 Sine Control

Refer to Fig. 2-1 which shows the rear panel of the UD320 HSDSP. On the right-hand side of the panel are the eight acceleration input connections of the 400AT System.

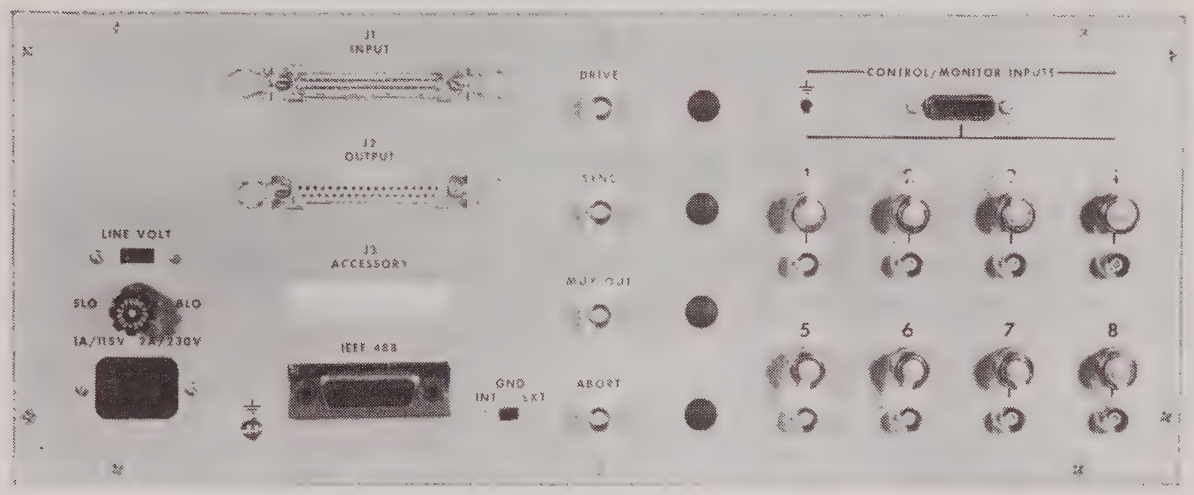


Fig. 2-1 Rear Panel - Model UD320 HSDSP

Refer to Fig. 2-2 which shows the rear panel of the UD345 SINE CONTROL. Near the middle of the panel are the eight acceleration input connections of the 400AT/S System, when the average control option is supplied.

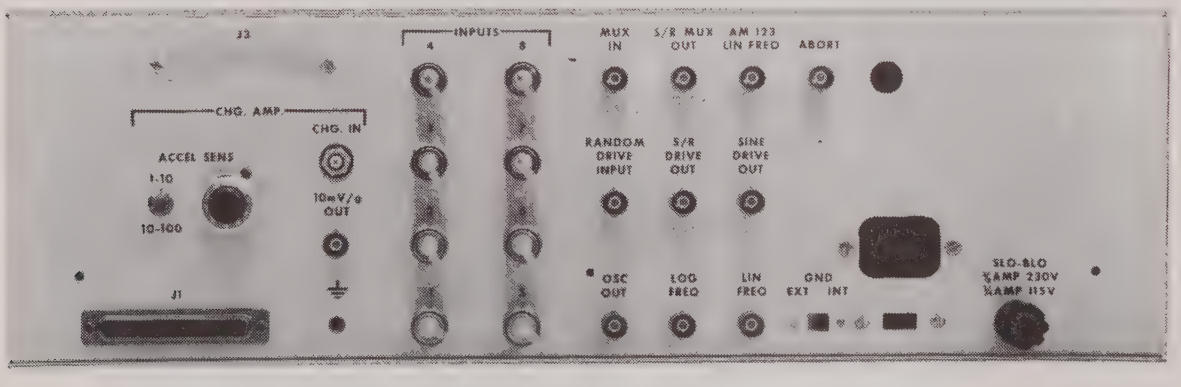


Fig. 2-2 Rear Panel - Model UD345 SINE CONTROL

For the UD320 in Fig. 2-1:

When used with a Model CVA-8 Eight Channel Signal Conditioner, connect J1 (CVA-8) to the rectangular 15 socket control/monitor inputs connector by means of a mating 15 conductor cable. Make sure the shorting caps are disconnected on each of the 8 input BNC connectors below the rectangular connector.

Otherwise connect the servo outputs of appropriate accelerometer signal conditioners to the BNC connectors numbered 1 through 8. Put shorting caps on those channels not connected to signal conditioners.

For those channels connected to external signal conditioners, make an additional coaxial connection from the BNC input connector on the UD320 to the BNC input connector having the same number on the UD345. (Note that the two paralleled BNC input connectors for each channel are also common with a pair of pins in the 15 pin D connector found above. This arrangement eliminates the need for BNC TEE connections.)

Connect the signal from DRIVE to the input connector of the power amplifier via a coaxial cable with BNC connectors. If the UD345 is also supplied, connect DRIVE (UD320) to RANDOM DRIVE INPUT. Then connect S/R DRIVE OUT (UD345) to the power amplifier input.

The MUX OUT connector (BNC) provides a buffered, time-division-multiplexed version of the input signals according to the TEST SETUP specifications. It is primarily intended to provide an input signal for the UD Model AM-123 Vibration Monitor/Limiter, for parallel system protection.

The ABORT input connector (BNC) accepts an external TTL abort signal for which a TTL-low signal or shorting of the center conductor to the shell causes an ABORT command to the vibration control system. Connect as desired.

The SYNC output connector (BNC) provides a TTL signal which is low whenever an output signal is being transmitted for shock/transient (400AT/T) operation. It may be used for synchronizing other measuring equipment.

The IEEE 488 connection was mentioned in Section 2.2. J1 and J2 are optional 37-pin D style connectors for a remote interface. J3 is intended for possible future use.

For the UD345 in Fig. 2-2:

The eight insulated BNC connectors near the center of the rear panel accept input signals from external (acceleration) signal conditioners at a sensitivity determined by the signal conditioners and menu entries. Those BNC connectors not connected via coaxial cable to signal conditioners must have the associated shorting caps seated securely over the unused connectors. See the above paragraphs for parallel connections to the UD320 inputs.

One internal charge amplifier is supplied with the UD345. It will accept a signal input through a noise-treated coaxial cable from a piezoelectric accelerometer at the miniature 10-32 CHG IN connector. The accelerometer sensitivity in pC/g is set on the potentiometer and range switch above the CHG IN connector. The 10 mV/g OUT connector then supplies a conditioned signal at the standardized sensitivity.

The 10 mV/g OUT signal may be connected externally to one of the INPUT connectors. (Usually Channel 1 for the control input.)

Connect the signal from SINE DRIVE OUT to the input connector of the power amplifier via a coaxial cable with BNC connectors. If the UD320 is also supplied, use the S/R DRIVE OUT to connect the drive signal to the power amplifier, as explained earlier.

The OSC OUT and LIN FREQ signals are used if tracking filters (UD Model TF22) are necessary to filter the 10 mV/g acceleration input signals.

As explained previously, J1 is used for a cable connection to the Host Computer with the Metrabyte Dascon 1 interface card.

The MUX OUT and the AM123 LIN FREQ connectors supply signals to the AM123 for parallel system protection. The Model UD345 incorporates a switching arrangement to supply automatically the proper MUX OUT signal from either the UD320 or UD345 for random or sine operation.

See Fig. 2-4 for a connection diagram involving the UD320 and UD345 for both sine and random operation.

2.5 Final Check

Make sure that all connections have been properly made between the Host Computer, Printer, Keyboard, Video Monitor, UD320 and UD345. Then check the connections made from the control accelerometers to the signal conditioners and the UD320/UD345, and also from the UD320/UD345 to the power amplifier. All power cords should be inserted into outlet boxes. Finally, the power cord from the Mounting Cabinet for the Host Computer should be connected to an outlet strip inside the system console.

At this point you can begin Chapter 3. A.C. power to the Mounting Cabinet can be turned on by pressing the PREAMP ON button for the UD System Console. Heed the following warning:

WARNING

It should be noted that the power to the UD320 HSDSP or UD345 SINE CONTROL should NOT be applied or removed when the power amplifier is turned on and the gain is turned up. With the power cords connected as suggested earlier, this should not be possible unless the operator toggles the UD320 power switch.

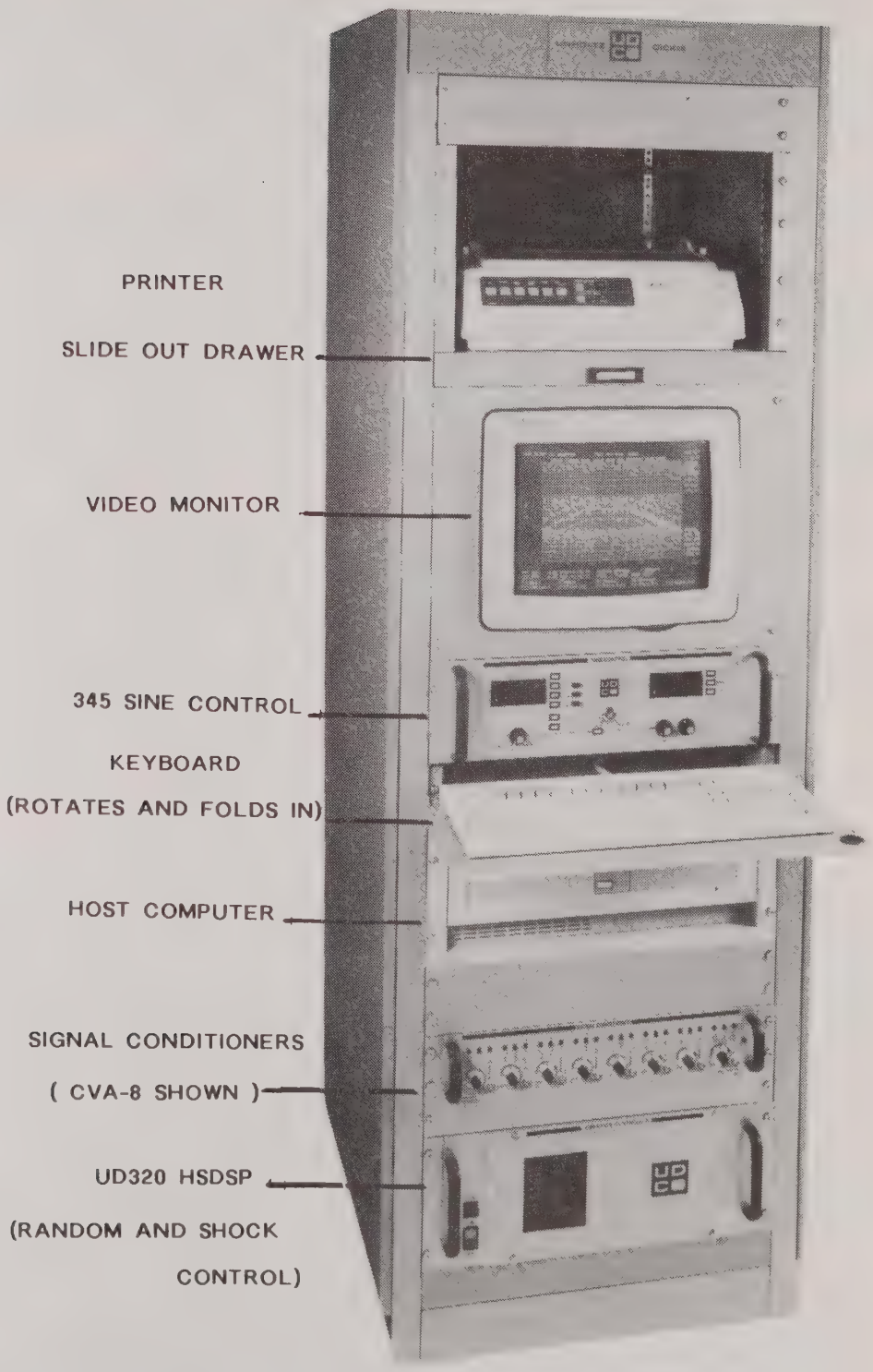


Fig. 2-3 400AT/R/S/T DIGITAL CONTROL SYSTEM
OPTIONAL HP VECTRA RACK MOUNT

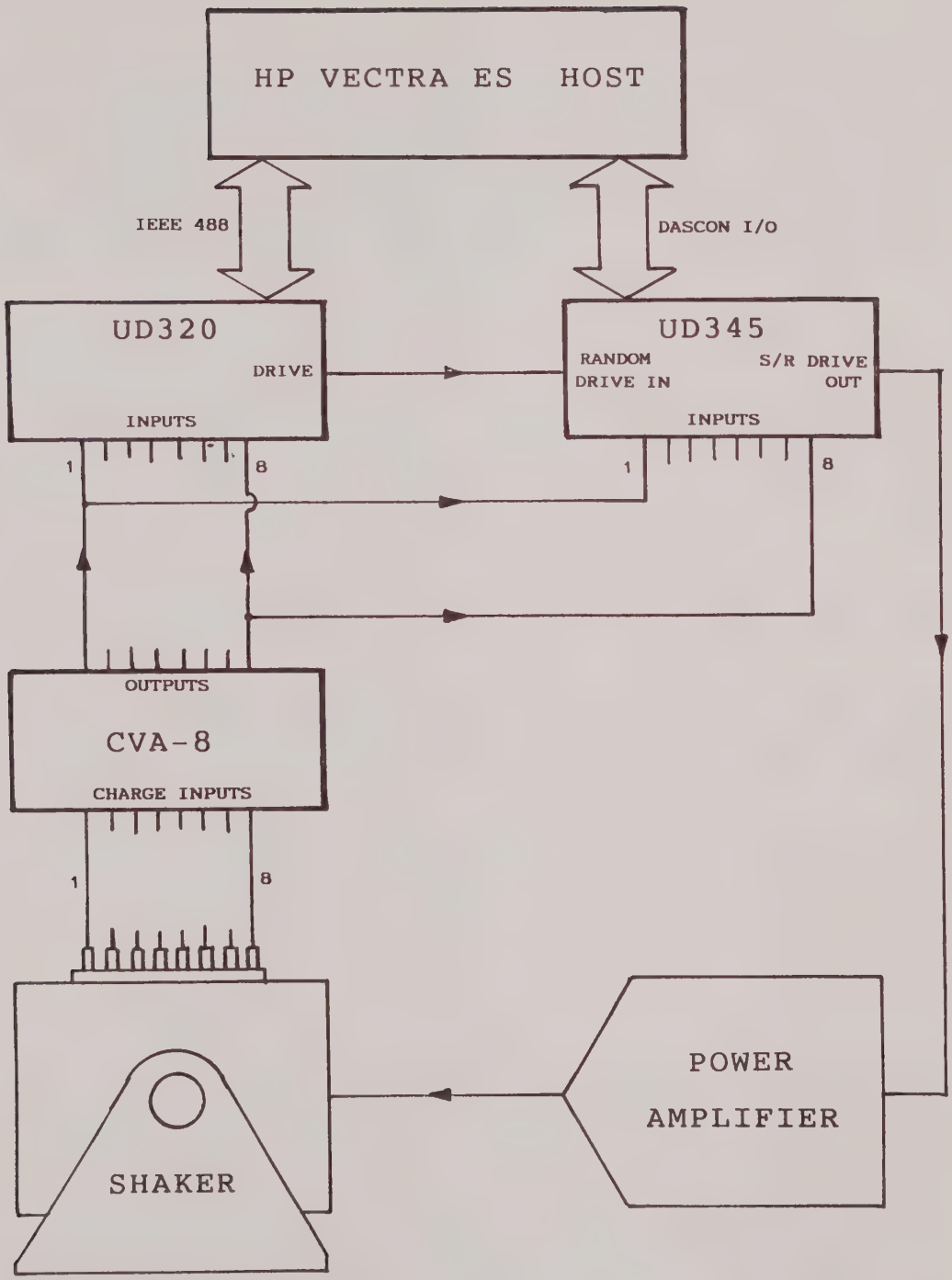


Fig. 2-4

Model 400AT/R/S/T

CONNECTIONS FOR COMBINED SINE, RANDOM AND SHOCK SYSTEM

3. PRELIMINARY SYSTEM OPERATION

3.1 Introduction

The U-D Model 400AT is extremely user-friendly, being extensively driven by responses to menus and requests appearing on the screen of the color monitor. All responses are entered on the keyboard of the host computer. In this chapter the operator is taken on a guided tour through the various menus and test description procedures. Practically all of the procedures need little additional description because operator requests for help cause explanative text to be displayed on the color monitor.

3.2 Initial Procedure

Make sure that the installation procedures described in Chapter 2 have been completed successfully. Actually, it is not necessary at this time that the system power amplifier be turned on, since all procedures in this chapter stop short of initiating a drive signal to the power amplifier from the UD320 HSDSP (Random and Transient control) or from the UD345 (Sine control).

Turn the monitor on by turning the upper knob clockwise. The middle knob adjusts the background level of test graphs displayed on the monitor. The lower knob adjusts the brightness of the display.

Turn on the line printer power switch. Make sure the SELECT indicator is lighted. Press the SELECT button if it is not. Turn on the power switches of the UD320 HSDSP, UD345 SINE CONTROL and the host computer.

The host computer proceeds through some initial internal checks and in less than a minute, the system logo is automatically displayed on the montior, a copy of which is shown on p. 3-3. The guided tour is almost ready to begin.

3.3 System Keyboard

The most common system keyboard is shown in Fig. 3-1. A top block of 12 keys, (F1) through (F12), are called FUNCTION KEYS. These keys are used to make entries from system menus and to control system operation when the vibration test is actually in progress.

The large block of keys contains the standard typewriter keyboard as well as three special purpose keys: (Ctrl), (Alt) and (Enter). The (Enter) key is used by the operator to confirm responses to queries appearing on the monitor. Numerical entries are most conveniently made from the keyboard since they are all lower case.

The CONTROL KEYS are (Esc)- escape, (End), (Ins)- insert, (Del)- delete, (PgDn)- page down, (PgUp)- page up, (PrtSc)- print screen, and the four cursor movement arrows. Some of these single-action keys are duplicated in the right-hand block, which contains

numbers as upper case entries. Numerical entries from the right-hand block are not recommended, since a (Shift) omission can cause an unwanted control key command.

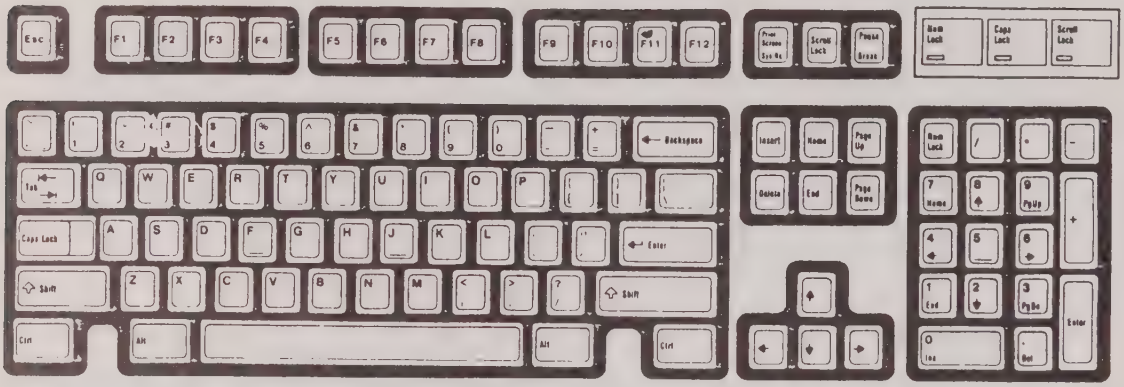


Fig. 3-1 Common System Keyboard

A less-common keyboard is shown in Fig. 3-2. It contains only ten FUNCTION KEYS, and the CONTROL KEYS are lower case entries on the right-hand pad except for (PrtSc), which is upper-case, and requires a simultaneous (Shift) entry.

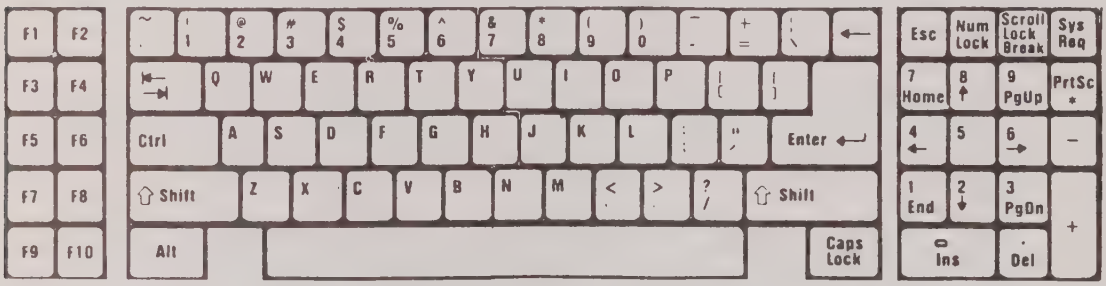


Fig. 3-2 Alternate System Keyboard

3.4 Important Special Commands

The (PrtSc) command causes the line printer to print only text appearing on the screen. It must not be used to print graphical displays introduced in following chapters. The (PrtSc) command was used to print the menus and HELP displays shown on the following pages.

Should any unusual action result in a situation for which the FUNCTION and CONTROL keys seem to be inoperative, press (Ctrl,Alt,Del) simultaneously. This will cause the monitor to go blank, and the host will repeat its initial self-checking action, with the System Logo on p. 3-3 reappearing.

YOU SHOULD NOW BE READY TO START THE PRELIMINARY GUIDED TOUR OF THE 400AT. Start on p. 3-3.

Following successful completion of Section 3.2, the System Logo is displayed on the Monitor:

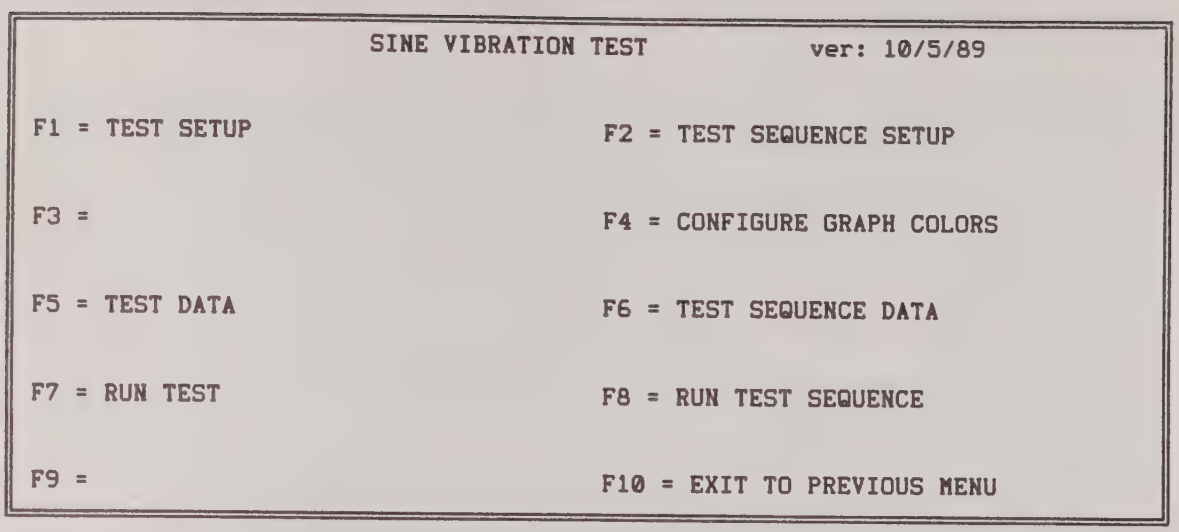
```
                        UNHOLTZ-DICKIE



                        MODEL  400AT

                DIGITAL VIBRATION CONTROL SYSTEM

     You may use the Model 400AT Digital Vibration Controller host software
and the UD320 Signal Processing software, as well as, all associated printed
materials under the terms of the UNHOLTZ-DICKIE Program License Agreement.
In summary UNHOLTZ-DICKIE grants you, as part of the price you paid for
this product, a non-transferrable personal license to use the standard system
software package (and options purchased) on a single Model 400AT unit.
You do not become the owner of the system software package nor do you have
the right to copy, transmit, or alter the software or the related printed
materials. You are legally accountable for any violation of the License
Agreement and Copyright laws.
                Copyright (c) 1986-1989 by Unholtz-Dickie Corp
ver 5.4      10/05/89 11:34:02     Alt F8 -> DOS    Alt F10 -> Park Disk Head
PRESS any KEY to ASSENT to the License Agreement and proceed with the program
```

Press any key to display the MAJOR OPERATIONAL MODES Menu below:

```
                    MAJOR OPERATIONAL MODES

F1 = RANDOM TEST                    F2 = REMOTE/KEYBOARD

F3 = SINE TEST                      F4 = MEASUREMENT/ANALYZE

F5 =                                F6 = MAINTENANCE/CONFIGURATION

F7 = SHOCK TEST                     F8 = HELP

F9 =                                F10 = EXIT
```

SELECT A FUNCTION KEY

Press (F3) to display the SINE VIBRATION TEST Menu on p.3-4.
Selection of (F10) would display the System Logo again.


SINE VIBRATION TEST ver: 10/5/89
F1 = TEST SETUP
F2 = TEST SEQUENCE SETUP
F3 =
F4 = CONFIGURE GRAPH COLORS
F5 = TEST DATA
F6 = TEST SEQUENCE DATA
F7 = RUN TEST
F8 = RUN TEST SEQUENCE
F9 =
F10 = EXIT TO PREVIOUS MENU
SELECT A FUNCTION KEY
?-Help

Press (Shift,?) simultaneously to obtain the HELP display shown on p.3-5. This offers further explanation of the action of the FUNCTION KEYS.

Note that all possible CONTROL KEY selections are shown at the bottom of each display, as well as other instructions.

SINE VIBRATION TEST MENU

All key selections display new menus except F7 & F8.
Access to most of the function keys described below can be controlled through the OPERATOR ACCESS selections in the MAINTENANCE/CONFIGURATION menu.

F1 - TEST SETUP - A test setup is the specification and entry of all test parameters. This menu allows various operations with saved test setups as well as creation of new setups.

F2 - TEST SEQUENCE SETUP - A test sequence is a group of test setups which run automatically in the listed sequence. The menu allows various operations with a saved test sequence as well as creation of a new sequence. The sequence may consist of a mix of Random, Sine and Shock tests.

F4 - CONFIGURE GRAPH COLORS - Provides a menu that allows the user to select the colors used in graphs.

F5 - TEST DATA - This menu allows various operations with saved test data, including displaying, printing, deleting and listing.

PgDn - to continue Esc - back to menu

Press (PgDn) to display the second HELP page:

SINE VIBRATION TEST MENU

F6 - TEST SEQUENCE DATA - Menu allows various operations with test data that was saved during a test sequence.

F7 - RUN TEST - Allows a test to be started. The first default entry is the most recently used test setup. This entry may be overwritten with any other saved test setup ID. Two additional default entries, identifying the method of automatically storing data and a test run name, may also be overwritten. If the 8 channel save option was purchased, there will also be an entry for the list of analysis channels to be sampled, which defaults to the list that was entered in the test setup.

F8 - RUN TEST SEQUENCE - Initiates a test sequence. The maximum number of test runs in a sequence is 999. The random, shock and sine test data save defaults are selectable in the DEFAULT TEST ENTRIES section of the MAINTENANCE/CONFIGURATION menu.

PgUp - back up one screen Esc - back to menu

Press (Esc) to return to the SINE VIBRATION TEST Menu on p.3-4.
Press (F1) to display the SINE TEST SETUP Menu on p.3-6.

```
                    SINE TEST DATA

F1 =                                    F2 =

F3 = DISPLAY TEST GRAPH                 F4 = DISPLAY TEST RUN LIST

F5 =                                    F6 = PRINT TEST RUN LIST

F7 = DELETE RUN                         F8 =

F9 =                                    F10 = EXIT TO PREVIOUS MENU
```

SELECT A FUNCTION KEY

?-Help _____

Press (Shift,?) to display the HELP page below:

```
                    SINE TEST DATA MENU

F3 - DISPLAY TEST GRAPH - Allows operator to view the graphs of acceleration
     vs frequency that were stored during a test run. The test data is
     specified by the test setup name and the test run name. The default
     entries are for the test setup ID, and the test run name for the most
     recently saved data. They may be overwritten.

F4 - DISPLAY TEST RUN LIST - Displays a menu to view, in various levels of
     detail, lists of saved test data for quick review and to help locate
     specific data sets.

F6 - PRINT TEST RUN LIST - Allows printing of the items on the menu displayed
     by F4.

F7 - DELETE TEST DATA - Allows entry of the test setup ID and test run name
     to remove the corresponding stored data from the hard disk. All test
     data sets for the specified test run are deleted.

                         Esc - back to menu
```

Press (Esc) to return to the SINE TEST DATA Menu above.
Press (F10) to return to the SINE TEST Menu on p.3-4.
Press (F7) and the RUN TEST entries appear below the Menu as shown on p.3-9.

Default entries appear for the four queries appearing below the SINE VIBRATION TEST Menu. If these four entries were satisfactory, the operator would press (Enter) four times to confirm the entries and thus begin the TEST RUN. The TEST RUN NAME is updated after each TEST RUN for which data is saved (i.e. from RUN27 to RUN28), so that it is frequently unnecessary to change the TEST RUN NAME.

Making numerical entries in the ANALYSIS CHANNEL SAMPLING SEQ. allows simultaneous plotting of the responses of these channels on one graph during the test.

At this point, however, follow the instructions below.

```
                    SINE VIBRATION TEST          ver: 10/5/89

F1 = TEST SETUP                          F2 = TEST SEQUENCE SETUP

F3 =                                     F4 = CONFIGURE GRAPH COLORS

F5 = TEST DATA                           F6 = TEST SEQUENCE DATA

F7 = RUN TEST                            F8 = RUN TEST SEQUENCE

F9 =                                     F10 = EXIT TO PREVIOUS MENU

RUN TEST SETUP-ID.............: DEMO
ENTER RUN NAME................: RUN1
SAVE DATA AUTOMATICALLY?......: 4
     <1=FIRST AND LAST SWEEP,2=ALL SWEEPS,3=LAST SWEEP,4=NO>
ANALYSIS CHANNEL SAMPLING SEQ :  , , , , , , ,

     Esc (Back to Menu)      Enter (Accepts Entry)
```

The flashing cursor is under the first symbol of the TEST SETUP ID.

Press (Enter), and the cursor advances under the first symbol of the RUN NAME.

As a further comment at this time, no attempt is made to overwrite the default entry for the TEST SETUP ID, because we have no way of knowing the ID's for other saved TEST SETUPS. This apparent difficulty is solved later.

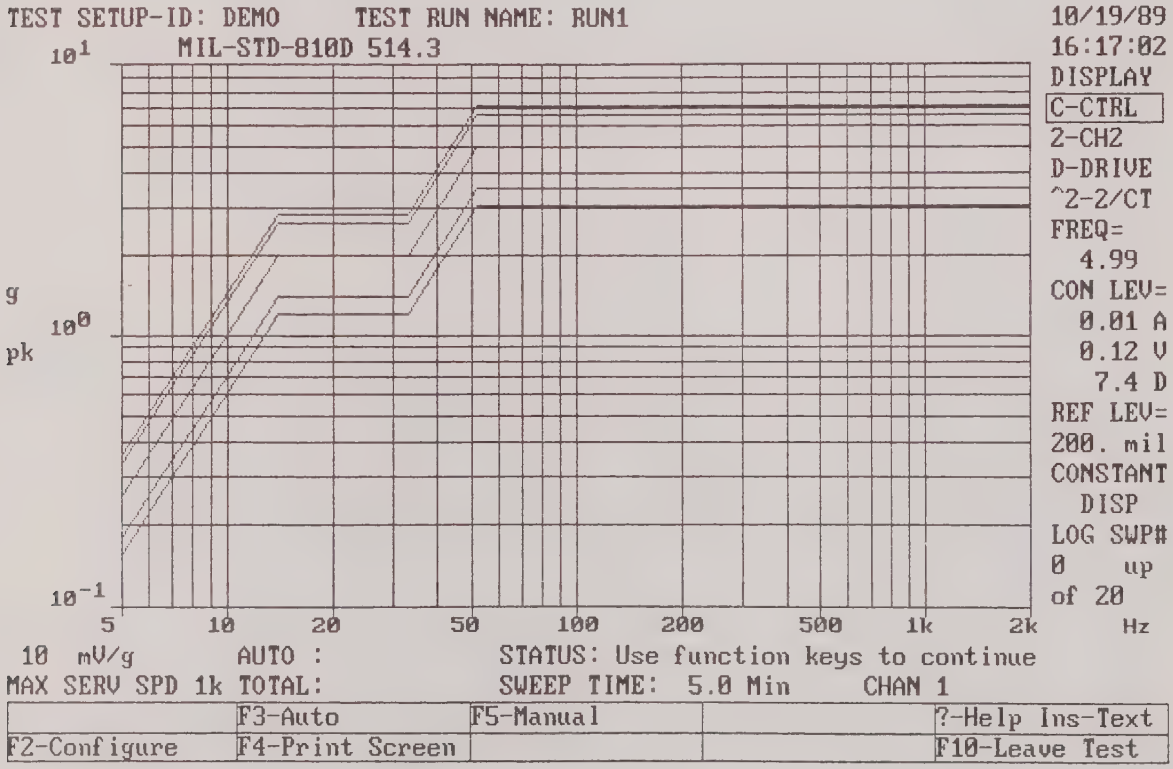
Press (Enter), the overwrite the third entry with (2) from the central keyboard. Press (Enter) twice, thus not making any numerical entries for the last query.

The graphical display on the following page appears.

The display below shows a graph of the reference acceleration vs frequency for the sine test setup DEMO. The alarm and abort limits are also indicated. The copy below is about 75% of the size of the actual color monitor display and the printer copy, which was obtained by pressing (F4). Other test information is shown on the borders of the graph.

At this time we will not proceed further with the test, before we examine the details of the SINE TEST SETUP on the following pages.

Note that it is really not necessary to have the UD345 SINE CONTROL connected to the Host Computer to proceed through Chapter 3.



If the UD345 were not connected to the Host Computer, the STATUS message would have read "UD345 Interface Failure".

Press (F10) to leave the test, and return to the SINE VIBRATION TEST Menu on p.3-4.

Press (F1) and the SINE TEST SETUP Menu on p.3-6 appears.

Proceed to p.3-11.

Press (F1), causing the default entry for the TEST SETUP ID to appear below the Menu.

```
                    SINE TEST SETUP

F1 = CREATE/EDIT                    F2 = RENAME

F3 = DISPLAY                        F4 = DISPLAY TEST SETUP LIST

F5 = PRINT                          F6 = PRINT TEST SETUP LIST

F7 = RUN TEST                       F8 = DELETE

F9 = COPY                           F10 = EXIT TO PREVIOUS MENU
```

```
CREATE/EDIT TEST SETUP-ID : DEMO

ROOM AVAILABLE ON DISK FOR 2435 TEST SETUPS
     Esc (Back to Menu)      Enter (Accepts Entry)
```

We are going to examine the parameters necessary to describe a TEST SETUP,and the means for entering them and changing them.

As a further commentary on the procedure followed on p.3-11 and p.3-12, note that the (F7)=RUN TEST choice again appears on the Menu above. However, we now have a means to determine TEST SETUP ID's other than the default entry by simply pressing (F4) or (F6).

The flashing cursor in the display above is under the first symbol of the default entry. We now have three choices:

1- To create a new TEST SETUP, type a new ID (8 symbols or less).
2- To examine and possibly edit another saved TEST SETUP, type the corresponding ID.
3- To examine and possibly edit the last-saved TEST SETUP, do not change the default entry.

We will follow the third choice.

Press (Enter), and the first page of line items for specifying the selected TEST SETUP is displayed as shown on p.3-12.

If a new TEST SETUP is being created, many line items have default entries to speed the setup process. These may be overwritten.

Practice moving the flashing cursor with the directional (arrow) CONTROL KEYS. See HELP page on p.3-14.

```
------------------------------------------------------------
                      SINE TEST SETUP

SETUP ID : DEMO
                                    Last Changed : 10/19/89 14:15:07
TEST DESCRIPTION : MIL-STD-810D 514.3

TEST TYPE : ..................>1
    <1=LOG SWEEP,2=LINEAR SWEEP,3=DISCRETE FREQUENCIES>

MAXIMUM SERVO SPEED : .........>3
    <1=100dB/sec, 2=300dB/sec, 3=1k dB/sec, 4=3k dB/sec>

INPUT SENSITIVITY : ...........>1
    <1=10mV/g,2=100mV/g,3=1000mV/g>

CONTROL CHANNEL INPUT SEQUENCE.>1, , , , , , ,
    <N=CHN FOR N=1-8>


ANALYSIS CHANNEL SAMPLING SEQ..> , , , , , , ,
    <N=CHN FOR N=1-8, or 0>

    ->          ?-Help
------------------------------------------------------------
```

Press (Shift,?) to display the HELP page below:

TEST SET UP Line Item Descriptions

Most of the line items have default entries with commonly occurring values or choices. These may be overwritten or customized by creating a test setup with the ID "DEFAULT" and selecting the appropriate values.

TEST DESCRIPTION - A one line (60 character maximum) description of the Test Setup.

SWEEP TYPE - Enter either logarithmic sweep, linear sweep, discrete (stepped) frequency (if purchased), or resonant dwell (if purchased). Note that resonant dwell may also be accomplished by choosing a swept test at this prompt and responding Yes to the RESONANT DWELL AT END OF SWEEPS prompt on the next page of the setup.

MAXIMUM SERVO SPEED - Four different compressor speed characteristics may be chosen. The compressor speed (dB/sec) varies from 10 dB/sec at 5 Hz to the maximum value (100, 300, 1k, or 3k dB/sec) at 5 kHz. The default value 1k dB/sec is usually adequate. However, using a tracking filter, providing average control, or encountering exceptionally high-Q resonances may require a lower value for amplitude stability. The choice of 3k dB/sec might be needed for exceptionally fast sweep rates.

PgDn - to continue Esc - back to menu

Press (PgDn) to display the next HELP page found on p.3-13.

The HELP pages below complete the explanation of the line items on p.3-12.

TEST SET UP Line Item Descriptions

INPUT SENSITIVITY - Select the input sensitivity desired and note that this applies to all input channels. Virtually all tests may be run with the 10mv/g input sensitivity. The 100mv/g and 1000mv/g selections are provided for those lower level tests (<100g peak for 100mv/g, <10 g peak for 1000mv/g) where a high noise environment is present and a better signal to noise ratio can be attained by using a higher input sensitivity. The charge amplifier output must, of course, be matched with the selected controller input sensitivity. If the internal charge converter is being used, 10mv/g must be selected since the converter only provides a fixed 10mv/g signal.

CONTROL CHANNEL INPUT SEQUENCE - Select one of the eight input channels for single channel control. If the average control option using an input multiplexor has been supplied, specify channels in the sequence desired. Specifying one of the input channels more than one time will cause its weighting to be proportionately higher than other channels appearing only once in the sequence. Note, however, that average control is provided for constant acceleration and sloped acceleration control segments only. The channel specified first in the sequence is used for any constant displacement and velocity segments in the program.

PgUp - back up one screen PgDn - forward one screen Esc - back to menu

Press (PgDn) to display the next HELP page:

TEST SET UP Line Item Descriptions

MULTI CHANNEL CONTROL STRATEGY - Select AVERAGE to multiplex the CONTROL CHANNEL INPUT SEQUENCE, or EXTREMAL to control to the highest of the channels. Note that with Extremal, all channels in the CONTROL CHANNEL INPUT SEQUENCE must also be entered in the ANALYSIS CHANNEL SAMPLING SEQUENCE.

ANALYSIS CHANNEL SAMPLING SEQ - Select the analysis channels to be sampled automatically, or enter 0 or leave blank to sample a single channel at a time. Sampling several channels automatically allows more than one channel to be viewed and stored for a single sweep. However, fewer analysis channel samples are taken when this method is used, so at fast sweep rates only a few channels can be meaningfully saved. Maximum sweep rate is 1 octave per minute with 8 channels, 2 octaves per minute with 4 channels, and 4 octaves per minute with 2 channels. Specifying a channel more than once does NOT increase the number of samples that can be viewed for that channel. Also, saving several channels automatically makes the remaining channels unavailable.

TEST SETUP CONTROL KEYS on next page

PgUp - back up one screen PgDn - forward one screen Esc - back to menu

Press (PgDn) to display the final HELP page, which describes the CONTROL KEY action. See p.3-14.

```
                    TEST SET UP CONTROL KEYS

 Esc      - Exits the setup without storing changes. A "Y" answer to the
            subsequent prompt verifies that this is the true intent of the
            operation. An "N" answer cancels the Esc command.

 Enter    - Moves the cursor to the next entry in the setup and displays
            the next page if necessary.

 End      - Saves all setup entries on the hard disk and then returns to the
            Test Setup Menu.

 PgDn/PgUp - Moves to the next/previous page of the setup.

 ↑↓- Moves the cursor to the entry above/below it.

 <-       - Moves the cursor one character to the left. If the cursor is on the
            first position of an entry it is moved to the first position of
            the entry to the left.

 ->       - Moves the cursor one character to the right.

          PgUp - back up one screen     Esc - back to menu
```

Press (Esc), then (PgDn) to display the next page og TEST SETUP line items, found below. You may want to practice editing entries. If an illegal entry is made, a flashing error message will usually appear.

```
      SETUP ID : DEMO        SINE TEST SETUP


LOWER FREQUENCY LIMIT (Hz) : ..>5
UPPER FREQUENCY LIMIT (Hz) : ..>2000

TEST LIMIT TYPE : .............>1
    <1=NUMBER OF SWEEPS, 2=TOTAL TIME>

NUMBER OF SWEEPS : ............>20
    <0=CONTINUOUS, 1 to 9999>

SWEEP TIME (Min) : ............>5
SWEEP RATE (Oct/min) : ........>1.73

STARTING SWEEP DIRECTION : ....>1
    <1=UP, 2=DOWN>
STARTING FREQUENCY (Hz) : .....>5

MANUAL START LEVEL<-20 to -6 dB>-20



   ->          ?-Help
```

Press (Shift,?) to display the first HELP page, shown on p.3-15.

TEST SET UP Line Item Descriptions

Most of the line items have default entries with commonly occurring values or choices. They may be overwritten.

LOWER FREQUENCY LIMIT - Enter the frequency at which the sweep direction reverses from down to up.

UPPER FREQUENCY LIMIT - Enter the frequency at which the sweep direction reverses from up to down.

TEST LIMIT TYPE - Select the manner in which the duration of the test will be determined.

NUMBER OF SWEEPS - Enter the total number of sweeps that are specified for the test. Sweeps alternate in the up and down directions. If it is desired to run the test manually, and the sweep may be reversed manually a number of times during the test, an entry of 0 for continuous sweep would probably be the best choice.

OR

TOTAL TIME - Enter the duration of the test in hours, minutes and seconds.

PgDn - to continue Esc - back to menu

Press (PgDn) to obtain the next HELP page:

TEST SET UP Line Item Descriptions

SWEEP TIME/RATE - Entering the SWEEP TIME for a single sweep between the FREQUENCY LIMITS causes the SWEEP RATE to be calculated automatically. Conversly, entering the SWEEP RATE in octaves/minute (logarithmic sweep) or hz./minute (linear sweep), causes the SWEEP TIME to be calculated automatically.

STARTING SWEEP DIRECTION - Enter the desired direction of the first sweep.

STARTING FREQUENCY - Enter the starting frequency. Note that if it is either the LOWER or the UPPER FREQUENCY, the STARTING SWEEP DIRECTION is also uniquely specified. If the LOWER or UPPER FREQUENCY is edited so that the STARTING FREQUENCY is outside this range, the STARTING FREQUENCY will be changed appropriately.

RESONANT DWELL AT END OF SWEEP - Enter Y to perform automatic resonant dwell on a resonance detected during the last sweep. If more than one resonance is detected, the resonances may be listed, but the dwell test will not be carried out automatically.

TEST SETUP CONTROL KEYS on next page

PgUp - back up one screen PgDn - forward one screen Esc - back to menu

Press (Esc), then (PgDn) to display the PROGEAM TABLE on p.3-16. The remaining HELP page is the same as that on p.3-14.

SETUP ID : DEMO PROGRAM TABLE

SEGMENT NO.	FREQUENCY (Hz)	FUNCTION (D,A,V,S)	LEVEL (mil pk-pk)	LEVEL (g-pk)	LEVEL (in/s-pk)	ALARM (+%)	ALARM (-%)	ABORT (+%)	ABORT (-%)
1	5	D	200	0.26	3.14	30	30	40	40
2	13.98	A	200	2	8.79	30	30	40	40
3	32.96	D	36	2	3.73	30	30	40	40
4	52.11	A	36	5	5.89	30	30	40	40
5	2000		0	5	0.15	30	30	40	40

LOWER FREQUENCY LIMIT = 5.0 Hz UPPER FREQUENCY LIMIT = 2000.0 Hz

-> Ins Del F2=Rescale ?-Help

Practice moving the cursor with the CONTROL KEYS, and editing the entries in the table. Flashing error messages usually acknowledge illegal entries. Errors not acknowledged immediately will be displayed if an attempt to return to the SINE TEST STEUP Menu is made via (Esc) or (End). Press (Shift,?) to display the HELP page:

TEST SET UP Line Item Descriptions - PROGRAM TABLE

Most of the line items have default entries with commonly occurring values or choices. They may be overwritten.

FREQUENCY - The entry gives the frequency at the low frequency end of each control segment.

FUNCTION - The entry specifies the vibration control function selected for each segment: D - displacement; A - acceleration; V - velocity, S - sloped acceleration. For sloped acceleration, the slope will be set so that the next crossover is smooth, and cannot produce level changes faster than .5 dB/sec.

LEVEL - The brightest level entry gives the vibration level of the controlled vibration function. The level of the other two functions are their corresponding values at the specified frequency.

ALARM - The alarm levels are specified relative to the control values for each of the segments. Default values of plus 32 percent and minus 24 percent for each segment are shown. These may be overwritten.

PgDn - to continue Esc - back to menu

Press (PgDn) to obtain the next HELP page found on p.3-17.

Note carefully the automatic calculations that are described on the HELP pages below.

TEST SET UP Line Item Descriptions

ABORT - The abort levels are specified relative to the control values for each of the segments. Default values of plus 40 percent and minus 30 percent for each segment are shown. These may be overwritten.
For EXTREMAL CONTROL, the alarm and abort levels are specified relative to the reference level for the channel which is highest relative to its reference level (specified on the table following this table).

A number of entry features of the Table are worth noting. The LOWER FREQUENCY LIMIT is automatically entered for SEGMENT #1 when the table is displayed, along with a function default entry of D. When the D is confirmed, the cursor moves to the displacement column of the LEVEL entry. When the displacement LEVEL is entered by the operator the other two levels are calculated automatically.

PgUp - back up one screen PgDn - forward one screen Esc - back to menu

Press (PgDn) to display the next HELP page:

TEST SET UP CONTROL KEYS

The entry for the FREQUENCY of SEGMENT #2 is accompanied by the automatic calculation of the vibration levels at this frequency, in accordance with the control level of SEGMENT #1. If A or V is entered and confirmed as the control function for SEGMENT #2, the cursor moves to the corresponding brightened level. Confirmation of the brightened value assumes a smooth transition from D to A or V at the crossover frequency. This procedure is repeated for all segments if different control functions are chosen for adjacent segments.

The last entry in the FREQUENCY column is the UPPER FREQUENCY LIMIT. Editing of all values except the FREQUENCY for the first segment may be made on the TABLE. This frequency must be edited on the line item for LOWER FREQUENCY LIMIT. If the UPPER FREQUENCY is omitted on the PROGRAM TABLE, it will be inserted automatically when the End command is given. Note that no other entries for the last segment no. can be made except the frequency, although the vibration levels are automatically inserted, except that when the last segment is 'S' the final acceleration level may be entered.

PgUp - back up one screen PgDn - forward one screen Esc - back to menu

Press (PgDn) for a description of applicable CONTROL and FUNCTION KEYS found on the next HELP page on p.3-18.

TEST SET UP CONTROL KEYS

Ins - Allows new segment entries at the cursor location without destroying existing segment entries.

Del - Deletes segment entry at the cursor location, and leaves remaining entries in order.

F2=Rescale - Rescales all level entries in the table by the specified change in dB.

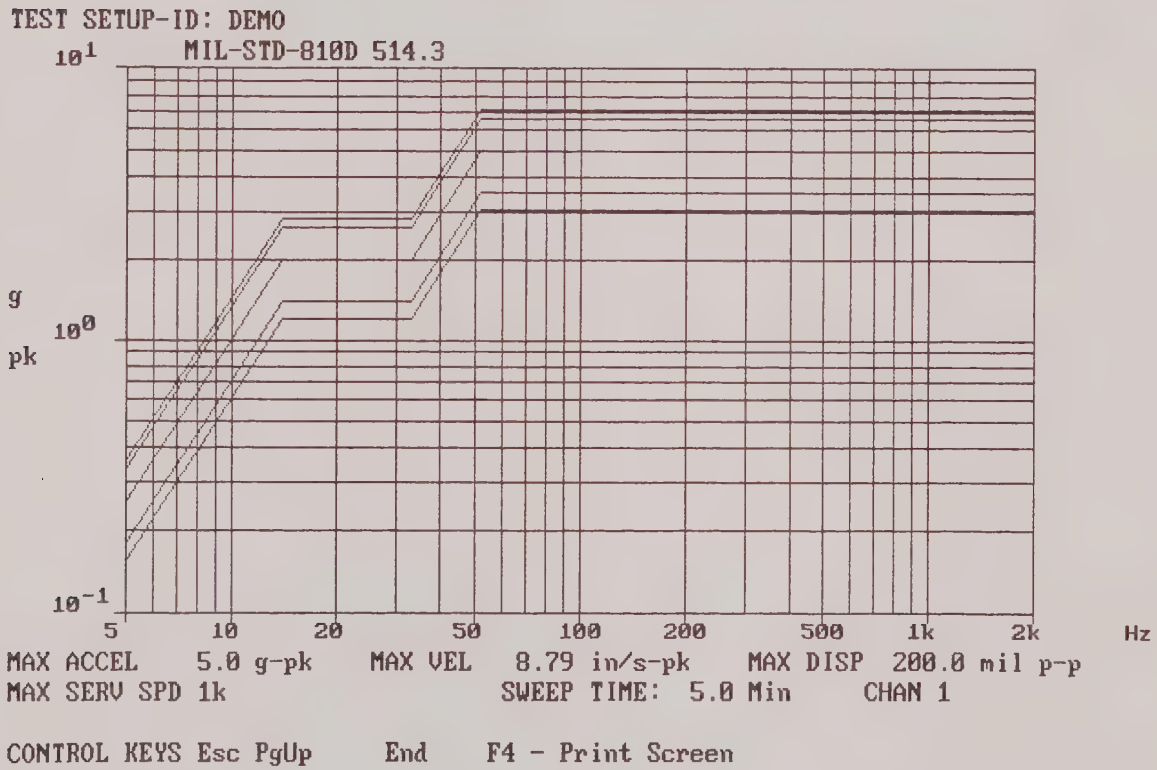
F6=Slope - Allows the slope to be set in terms of dB/oct. This key is only active when the cursor is at the acceleration level entry of the crossover at the high frequency end of a 'S' segment.

PgUp - back up one screen PgDn - forward one screen Esc - back to menu

The final HELP page is again ignored, since it is identical to the one on p.3-14.

Press (Esc), then (PgDn), to obtain the display of the Test Graph found on p.3-19. Acceleration vs. frequency, as described by the PROGRAM TABLE on p.3-16 is shown on this graph, which is approximately 75% of actual display size. The graphical displays are copied at full size, and rotated 90^{o} on the 8.5 x 11 printed sheet by pressing (F4).

The constant acceleration segments of 2g and 5g coincide with a grid line and no differentiation is seen on the black-and-white printed copy. Occasionally this will also happen for the associated lines for the ALARM and ABORT limits. A color printer, which is available for the 400AT/R/S/T,does provide different colors for the REFERENCE, ALARM and ABORT lines which supersede the background grid lines.



THIS MARKS THE END OF THE PRELIMINARY GUIDED TOUR OF THE UD 400AT/S. Operations necessary for running a complete test are explained in Chapter 4.

4. PERFORMING THE SINE VIBRATION TEST

4.1 Introduction

In Chapter 3 we took a detailed tour through the various menus and test description procedures. We did, however, stop short of actually initiating a sine vibration test (See pp. 3-9 and 3-10). Now we are ready to take the steps necessary for performing and completing a test run. These steps, as well as data display techniques and operational procedures that are possible during the performance of the test, are explained in the following sections.

4.2 Initial Procedure

As outlined in Section 3.2, make sure that all installation procedures described in Chapter 2 have been completed successfully. Also check that the remainder of the procedures in Section 3.2 has been followed. The power amplifier should be turned on so that it is ready to apply a signal to the shaker. See the manufacturer's instructions if necessary. The amplifier gain control should be adjusted for maximum gain.

Again, when the U-D 400AT System Logo appears on the color monitor, we are almost ready to start the test.

If it is desired to check the 400AT without exciting the power amplifier and shaker, this can be done by connecting an attenuator (gain 0.2) or shaker simulation network between the DRIVE output and the CHANNEL 1 input of the UD 345. The TEST SETUP entry for control channel sequence should show the single input channel.

4.3 Test Setup

As an aid to our understanding of the procedures in this chapter, and the parameters found on the graphical displays, we will obtain a copy of the SINE TEST SETUP that pertains to our TEST RUNS.

Press any key to display the MAJOR OPERATIONAL MODES Menu.
Press (F3) to display the SINE VIBRATION TEST Menu.
Press (F1) to display the SINE TEST SETUP Menu.
Press (F5) to print the SINE TEST SETUP used in the remainder of this chapter and found on p 4-2.

In response to PRINT TEST SETUP-ID: we typed (DEMO), (Enter).
In response to INCLUDE GRAPH <Y,N>? we entered (N). A copy of the printout for the SINE TEST SETUP parameters only is shown on the next page. The graph is shown on p 3-18.

The results described in the remainder of this chapter were actually taken on a U-D Model 5PM Shaker with a resonant load. The three control accelerometers were placed so that the acceleration responses differed considerably in the upper portion of the frequency range. In this fashion, the capability of the 400AT/S for average control and extremal control can be demonstrated.

SINE TEST SETUP

SETUP ID : DEMO

current date : 10/23/89
: 11:07:43
last updated : 10/23/89
: 11:03:59

TEST DESCRIPTION : MIL-STD-810D 514.3

TEST TYPE : .....>1
<1=LOG SWEEP,2=LINEAR SWEEP,3=DISCRETE FREQUENCIES>

MAXIMUM SERVO SPEED : .....>3
<1=100dB/sec, 2=300dB/sec, 3=1k dB/sec, 4=3k dB/sec>

INPUT SENSITIVITY : .....>1
<1=10mV/g,2=100mV/g,3=1000mV/g>

CONTROL CHANNEL INPUT SEQUENCE.>1, , , , , , ,
<N=CHN FOR N=1-8>

ANALYSIS CHANNEL SAMPLING SEQ..>1,2,3, , , , ,
<N=CHN FOR N=1-8, or 0>

LOWER FREQUENCY LIMIT (Hz) : ..>5

UPPER FREQUENCY LIMIT (Hz) : ..>2000

TEST LIMIT TYPE : .....>1
<1=NUMBER OF SWEEPS,2=TOTAL TIME>

NUMBER OF SWEEPS : .....>20
<0=CONTINUOUS,1 to 9999>

SWEEP TIME (Min) : .....>5

SWEEP RATE (Oct/min) : .....>1.73

STARTING SWEEP DIRECTION : ....>1
<1=UP,2=DOWN>

STARTING FREQUENCY (Hz) : .....>5

MANUAL START LEVEL<-20 to -6 dB>-20

SETUP ID : DEMO PROGRAM TABLE

SEGMENT NO.	FREQUENCY (Hz)	FUNCTION (D,A,V,S)	LEVEL (mil pk-pk)	LEVEL (g-pk)	LEVEL (in/s-pk)	ALARM (+%)	ALARM (-%)	ABORT (+%)	ABORT (-%)
1	5	D	200	0.26	3.14	30	30	40	40
2	13.98	A	200	2	8.79	30	30	40	40
3	32.96	D	36	2	3.73	30	30	40	40
4	52.11	A	36	5	5.89	30	30	40	40
5	2000		0	5	0.15	30	30	40	40

4.4 Beginning The Test Run

After the printout of the SINE TEST SETUP begins, the queries disappear on the screen, and the SINE TEST SETUP Menu remains.

Press (F7 - RUN TEST) and four queries appear below the Menu:

```
RUN TEST SETUP-ID.............: DEMO
ENTER RUN NAME................: RUN1
SAVE DATA AUTOMATICALLY?......: 4
     <1=FIRST AND LAST SWEEP,2=ALL SWEEPS,3=LAST SWEEP,4=NO>
ANALYSIS CHANNEL SAMPLING SEQ : 1,2,3, , , , ,

     Esc (Back to Menu)      Enter (Accepts Entry)
```

Confirm all default entries with the (Enter) key.
In a few seconds, a graph with notations around the border is displayed, like the one on p. 3-10. At the bottom is a two row display with space for describing the function of each of the ten FUNCTION KEYS. Only the active keys, however, have their function displayed in the associated space, and the remainder of the spaces are blank.

The following function keys are active:

(F2-Configure); (F3-Auto); (F4-Print Screen); (F5-Manual); (F10-Leave Test)

A choice of (F10) causes the S.V. TEST Menu to be displayed again. A choice of (F3) causes the system to ramp up to the level specified in the PROGRAM TABLE for the starting frequency, the auto clock is then started, the frequency starts sweeping, and continues for the number of alternating up and down sweeps specified in the setup if no further interruptions occur. If the system is unable to reach 90% of the reference level during ramping, the test will abort.

If the MANUAL mode (F5) is chosen, the level will ramp up to 20 dB below the level specified for the starting frequency, as specified by the TEST SETUP, and will remain at this level and frequency until further control operations are made. The AUTO clock does not run in the MANUAL mode, but the TOTAL clock runs continuously during the test run. The level may be changed by the up and down arrow keys on the numeric keypad, and the frequency may be changed by the right and left arrow keys.

The HELP pages may be displayed at any time during the test by pressing (Shift, ?) and are shown on the following pages. A summary of the CONTROL KEY action and various display alternatives is given in Figs. 4-1 through 4-5.

SINE TEST RUN

Access to most of the function keys described below can be controlled through the OPERATOR ACCESS selections in the MAINTENANCE/CONFIGURATION menu.

F1 - ABORT - When in the Auto Sweeping, Auto Hold or Manual modes, this stops the test by compressing the drive output at the maximum possible speed without generating any high frequency transients.

F2 - CONFIGURE - Provides a menu which enables the operator to change the manner in which the graph is displayed.

F3 - AUTO - Initiates automatic sweeps as specified in the setup. If pressed after an abort, it will resume sweeping where it stopped. If pressed during manual, it will sweep from the current frequency.

F4 - PRINT SCREEN - Causes the current display to be printed on the printer.

F5 - MANUAL - Enters the Manual mode, in which frequency and level may be controlled by the cursor keys.

F1 - Abort F4 - Print Screen PgDn - next page Esc - back to graph

Fig.4-1

SINE TEST RUN

F6 - STORE DATA - Saves data on the hard disk. In the Auto mode, data is saved since the last reversal; in the Manual or Local modes data is saved since the CURSOR TRACE was set to 'Yes' in the Configure Menu.

F7 - REVERSE SWEEP - When in the Auto Sweep or Auto Hold modes, this causes a sweep in the opposite direction.

OR

F7 - GOTO FREQ - In the Manual mode, this provides a prompt which allows the operator to select a new frequency.

F8 - LEAVE SEQ - Returns to the SINE VIBRATION TEST MENU without performing the remaining tests in the sequence.

F10 - LEAVE TEST - Returns to the SINE VIBRATION TEST MENU, or performs the next test in the sequence.

F1-Abort F4-Print Screen PgUp-previous page PgDn-next page Esc-back to graph

Fig.4-2

SINE TEST RUN

F9 - AUTO HOLD - Stops the sweep while maintaining the level.

OR

F9 - SWEEP - Resumes the sweep after Auto Hold mode has been entered.

OR

F9 - LIST RESONANCES - Prints a list of resonances on the printer for all the analysis channels that were sampled in the most recent sweep. The user is prompted for a minimum ratio which the level must reach in order to qualify as a resonance. If g/v is displayed on the vertical axis then the ratio will be the analysis channel divided by the drive voltage, otherwise it will be the analysis channel divided by the control channel. In order to distinguish between several resonances on a single channel, the level must drop below this ratio between each resonance. If half-power points can be found on each side of the resonance, the Q will be listed. It is calculated as the frequency at the highest level divided by the difference in the half-power point frequencies.

INS - ANNOTATE - Enter the Annotate mode to permit the operator to put text on the graph.

F1-Abort F4-Print Screen PgUp-previous page PgDn-next page Esc-back to graph

Fig.4-3

SINE TEST RUN

C-CTRL - Press C to display graph for the control channel. Note that for EXTREMAL control, the color in which the data is plotted indicates which channel is being controlled, and that only the PROGRAM TABLE reference levels are displayed, although some channels may use different reference levels.

n-CHn - Press 1 through 8 to display graph for the corresponding anaylsis channel. If no ANALYSIS CHANNEL SAMPLING SEQ has been specified, then selecting a channel other than the one currently being sampled (indicated by the number displayed in n-CHn) will cause the data for the current analysis channel to be forgotten. If an ANALYSIS CHANNEL SAMPLING SEQ has been specified, only those channels which are listed in the sequence may be displayed.

A-ALL - Press A to display graph for all analysis channels that were specified in the ANALYSIS CHANNEL SAMPLING SEQUENCE.

^A-A/CT - Press Alt and A simultaneously to display graph of response ratios for all analysis channels in the ANALYSIS CHANNEL SAMPLING SEQ to the control channel.

F1-Abort F4-Print Screen PgUp-previous page PgDn-next page Esc-back to graph

Fig.4-4

SINE TEST RUN

^n-n/CT - Press Alt and 1 through 8 simultaneously to display graph of response ratio for the specified analysis channel to the control channel. The same restrictions on changing channels as for n-CHn apply.

D-DRIVE - Press D to display graph for the drive voltage.

<- -> - In Manual mode, decrease or increase the frequency 1% (1 Hz for linear sweeps). In discrete frequency tests, the frequency may not change by more than 10 % from the current level step frequency. In extremal tests, these keys are inactive during the Manual mode. After the test finishes or is aborted, move the cursor to an adjacent data point. Pressing the shift key at the same time will increase the size of the change, to 10% (12.5 Hz for linear sweeps) in the Manual mode, or 20 data points after the test finishes or aborts.

↑↓ - In Manual mode, raise or lower the level by .1 dB. Pressing the shift key at the same time will raise or lower the level by 1 dB.

F1 - Abort F4 - Print Screen PgUp - previous page Esc - back to graph

Fig.4-5

We will choose the AUTO mode to initiate the test:

Press (F3).

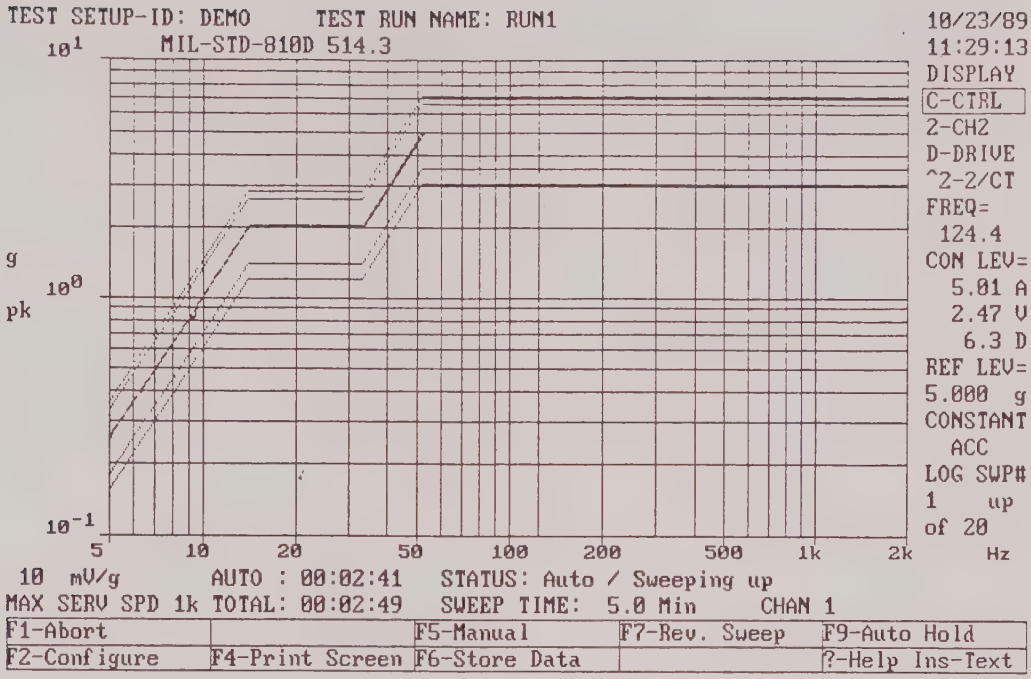
Immediately, the Status changes to "Ramping" and (F1-Abort) is the only active FUNCTION key. After a few seconds, the level comes up, and the Status changes to "Auto/Sweeping up". The display is nearly identical to Fig. 4-6 on the next page.

The test has begun.

4.5 During the Test Run

The displays shown in the remainder of the chapter were obtained from printed copies obtained by pressing (F4-Print Screen) when a copy was desired. The (F4) command causes the graphical displays to be rotated 90 degrees before appearing on the printer paper. This allows the graphical material to occupy a full sheet of the 8.5 x 11 printed copy. The copies shown in this manual are reduced to approximately 65% of full size to conserve space. Do not attempt to use the (Shift, PrtScr) command to print graphical displays, because this cause useless printer output.

Fig.4-6



Note that the moving cursor during the sweep is shown at 124.4 Hz in the display above.

Most relevant test information can be found on the display. On the top border, the TEST SETUP-ID and TEST RUN-NAME are given, with the TEST DESCRIPTION from the setup on the line below. In the upper right-hand corner the current date and time are shown.

On the right border, the parameters which can be plotted on the graph are listed under DISPLAY, with the one currently in use surrounded by a box. Below these are: the actual frequency; the actual control level in g-peak, in/s-peak and mils pk-pk; the reference level for the segment; the sweep number; the maximum number of sweeps (or "continuous").

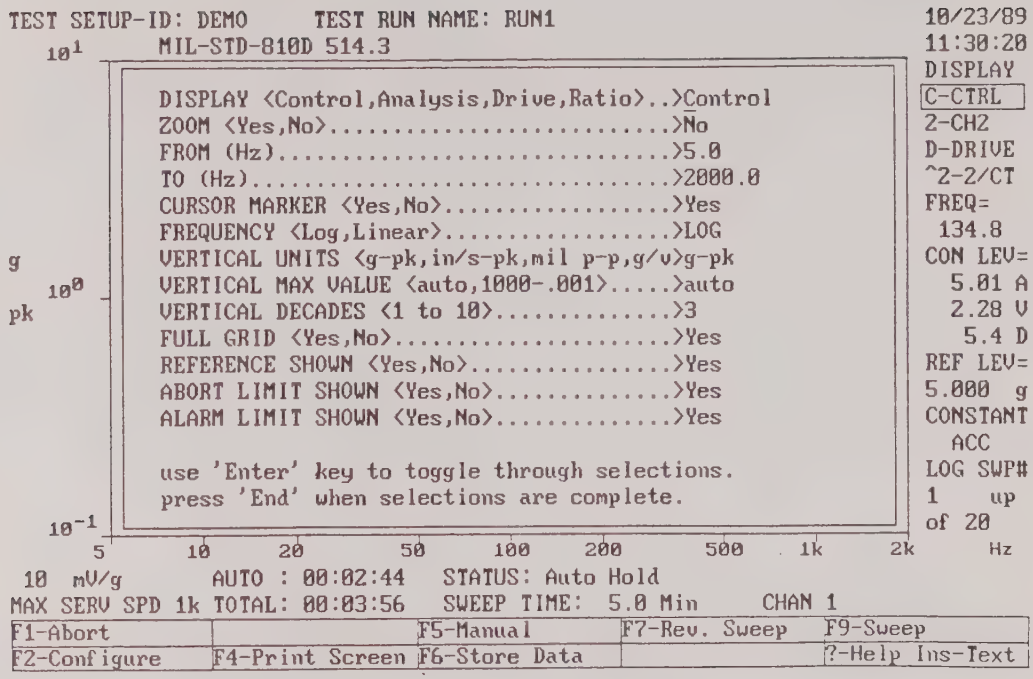
Below the graph, CHAN indicates the channels that are averaged to produce the control level, and SWEEP TIME indicates the time that a full up or down sweep will take.

There are two clocks which relate to test duration. AUTO displays the time during the test spent AUTO sweeping only. TOTAL displays the time elapsed since the graph was initially displayed after RUN TEST was pressed.

The MAX SERV SPD entry indicates the compressor speed (in dB/sec) that was selected in the setup to occur at 5 kHz.

To change the configuration of the test graph, press (F2-Configure). The configuration parameters then appear in place of the graph as shown in Fig. 4-7.

Fig.4-7



To change one of these parameters, move the cursor up or down to the parameter to be changed, and press (Enter) to toggle to the desired new selection. The FROM and TO are numerical selections which must be typed and confirmed.

DISPLAY - The variable appearing on this graph as a function of frequency is selected here. Four choices are available: Control, Analysis, Drive Voltage, or Transfer Ratio. Each of these has its own dimensional units which appear in the parameter selection VERTICAL UNITS.

ZOOM - A 'Yes' response activates the numerical frequency limits for the horizontal axis in the FROM and TO entries. Otherwise the 'No' response provides the entire frequency range specified in the SINE TEST SETUP.

CURSOR MARKER - A 'Yes' response provides a bright vertical cursor at the current frequency. In the MANUAL or LOCAL modes, this parameter becomes CURSOR TRACE. A 'Yes' response produces a single dot which produces a trace as the frquency and amplitude is varied. The 'No' response produces a cursor shaped like plus sign which moves to show the current amplitude and frequency.

FREQUENCY - Selection of logarithmic or linear frequency scales is provided. The sweep type specified in the SINE TEST SETUP does not change however.

VERTICAL UNITS - Selection of acceleration velocity or displacement units is provided for Control or Analysis Channel displays. Note that the units are peak values for acceleration and velocity and peak-to-peak for displacement. The units for a Drive Voltage display are rms volts. The Transfer Ratio display is dimensionless.

VERTICAL MAX. VALUE - Selection of 'Auto' provides maximum and minimum decade values that will allow plotting of the entire reference vibration level and the associated abort limits for the Control and Analysis Channel displays. Otherwise the maximum value is determined by the numerical selection chosen from .001 to 1000 g.

VERTICAL DECADES - The entry is ignored if 'Auto' is chosen above. Otherwise the numerical number of decades chosen provides a minimum value for the vertical axis. The scaling is logarithmic.

FULL GRID - A 'Yes' response provides a full set of horizontal and vertical grid lines. Otherwise no background lines are presented.

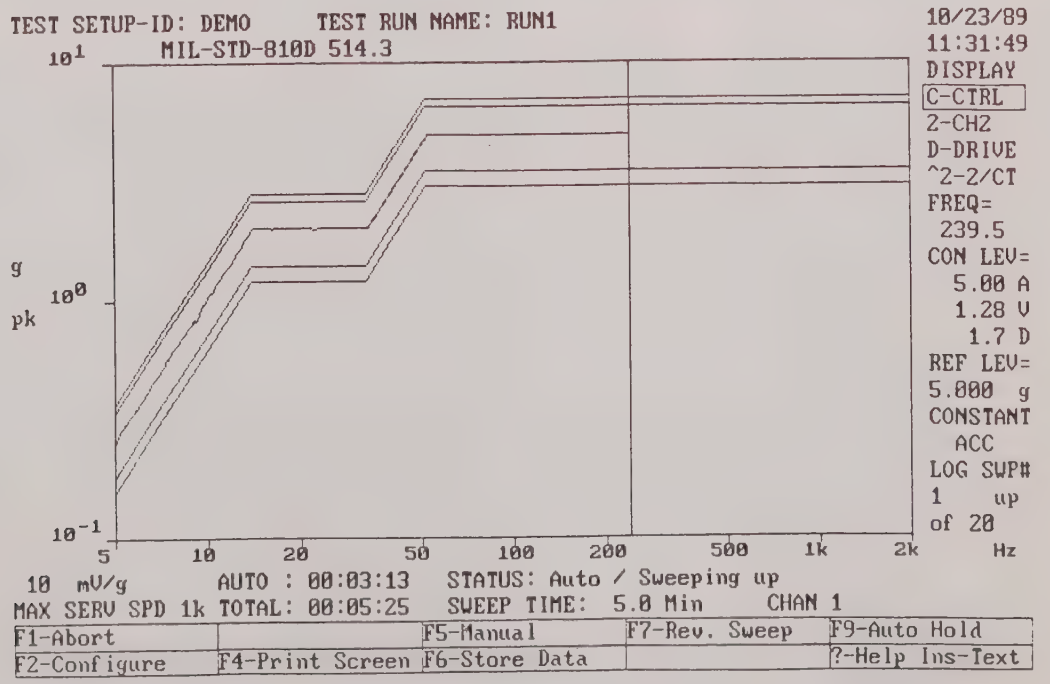
REFERENCE SHOWN - A 'No' response eliminates the display of the reference vibration level as a function of frequency.

ABORT/ALARM LIMIT SHOWN - A 'No' response eliminates the display of the abort/alarm limits on the graph.

ANAL. CHAN. MAX. VALUE - This parameter is shown only if the Analysis Channel is selected for display. The response is similar to that for VERTICAL MAX. VALUE.

Some operators may prefer not to see the grid lines or the reference acceleration, as they may tend to obscure some data details. To remove the grid lines, move the cursor to FULL GRID and toggle to the "No" response by pressing the (Enter) key. To remove the reference acceleration graph, move the cursor to REFERENCE SHOWN and toggle "No". The resulting display is shown in Fig. 4-8 below.

Fig.4-8



When the independent analysis channel has been supplied, the data for this channel may be seen by pressing (2), the number associated with the Analysis channel. Channel 1 is always the control channel when the averaging option has not been supplied. If 8-channel averaging has been supplied, channels 1 through 8 are available for viewing and any sequence of as many as 8 channels is available for control. Assuming that the averaging option has been supplied, press (2) and then (3) to obtain the graphs in Figs. 4-9 and 4-10.

Fig.4-9

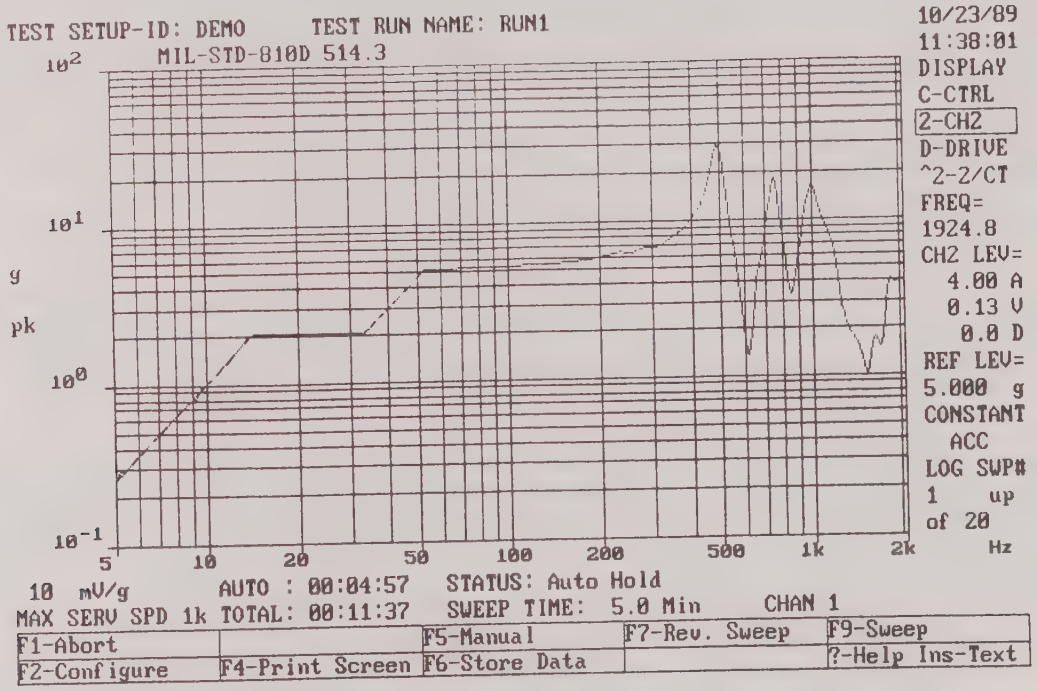
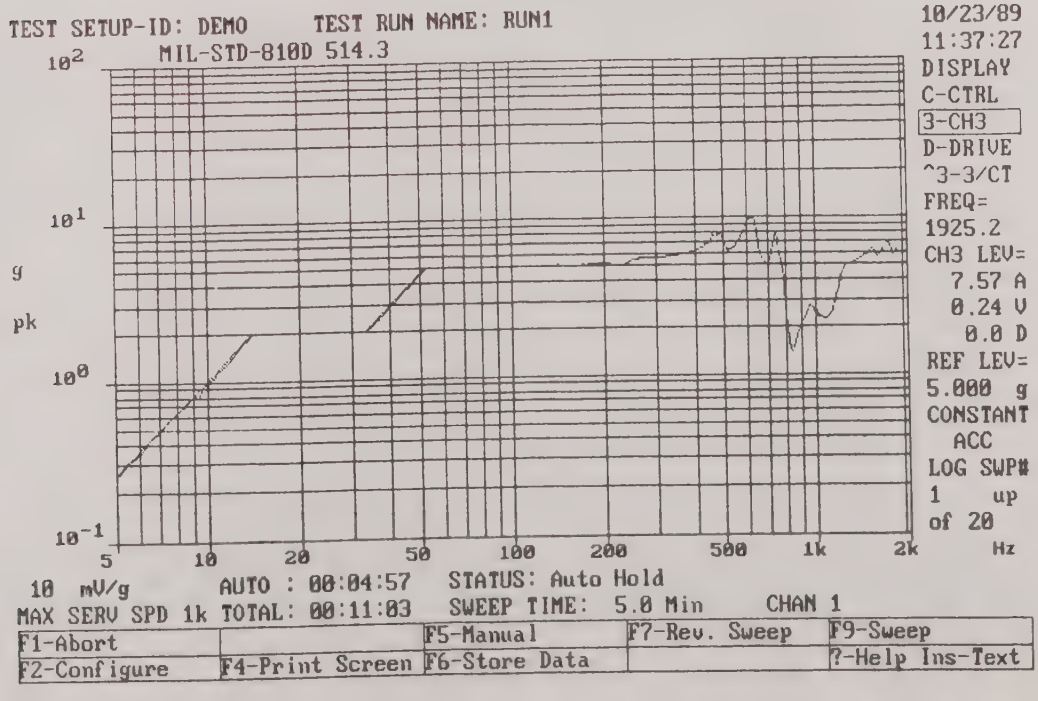
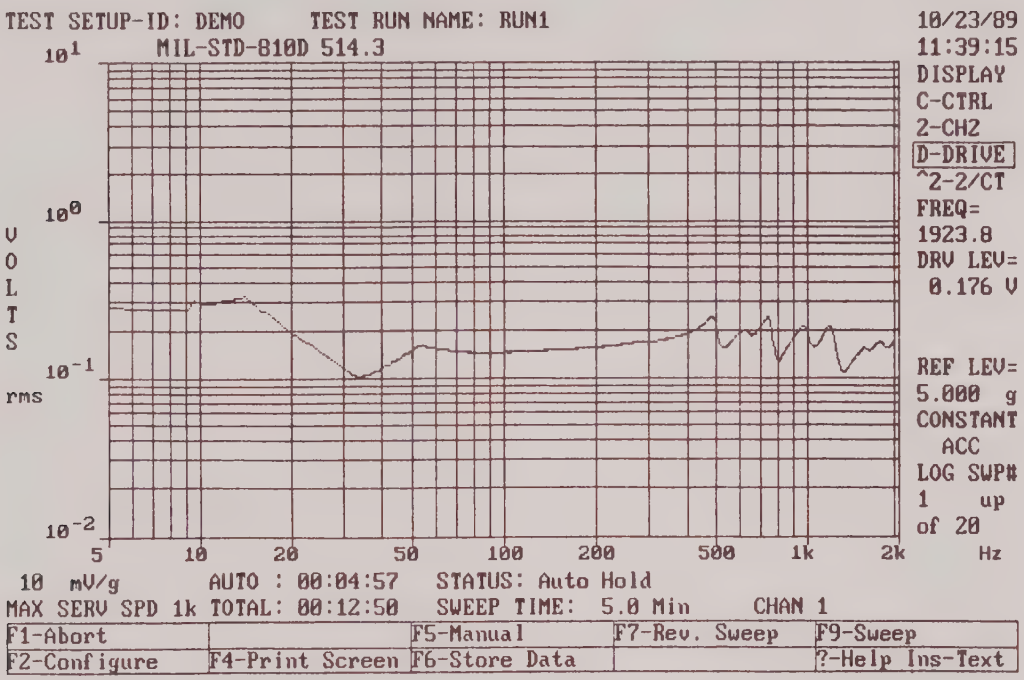


Fig.4-10



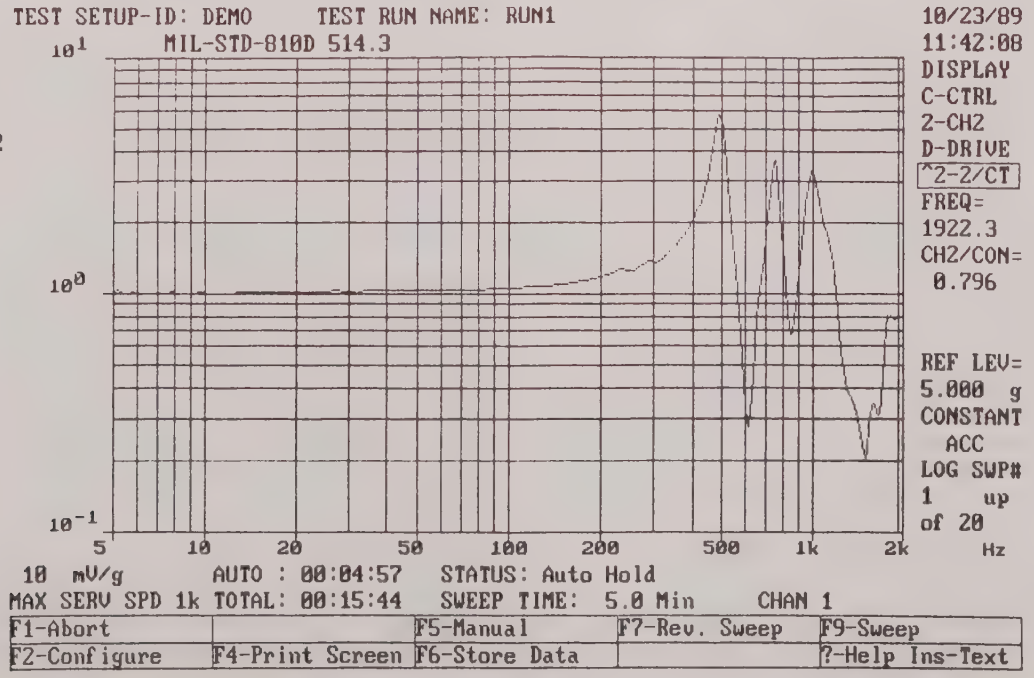
The drive voltage is viewed by pressing (D) and is shown in Fig. 4-11.

Fig.4-11



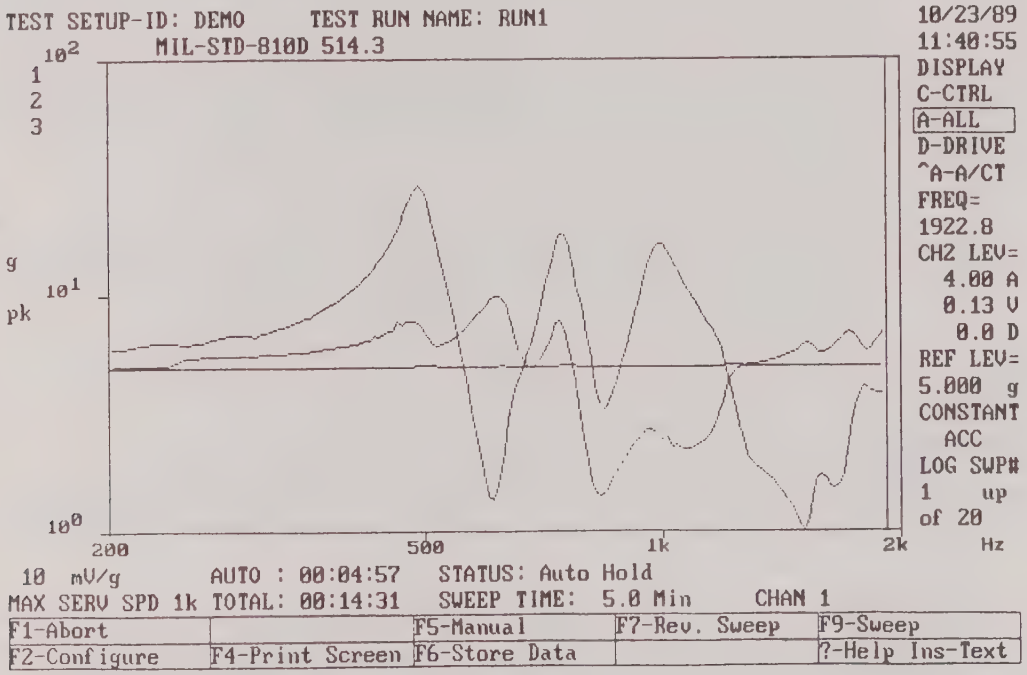
The transfer ratio of the acceleration of the Channel 2 to the acceleration of the Control channel is viewed by pressing the keys (Alt,2) simultaneously. The display is shown in Fig. 4-12.

Fig.4-12



Reconfiguring the analysis channel display for no grid lines and for zoom frequency between 200 and 2000 Hz, and then pressing (A) allows all the analysis channels in the sampling sequence to be displayed simultaneously. The result is shown in Fig. 4-13. The displayed channel responses are color-coded by the numbers appearing in the upper left-hand corner of the display.

Fig.4-13



4.6 MANUAL Mode

The MANUAL Mode allows the operator to operate the system from the keyboard and change both frequency and amplitude by using the four arrow CONTROL KEYS. At all times the vibration amplitude remains under closed-loop control.

Press (F5) to establish the MANUAL Mode. If the MANUAL Mode was entered when the system was sweeping at the reference level (AUTO Mode) or being held at the reference level (AUTO HOLD Mode), any frequency sweep stops and the vertical cursor is replaced by the cursor shaped like a large plus sign. The controlled vibration level is the reference level.

If the MANUAL Mode is entered to begin the test, or after the test is aborted by pressing (F1), the vibration level ramps automatically to a level 20 dB below the reference level.

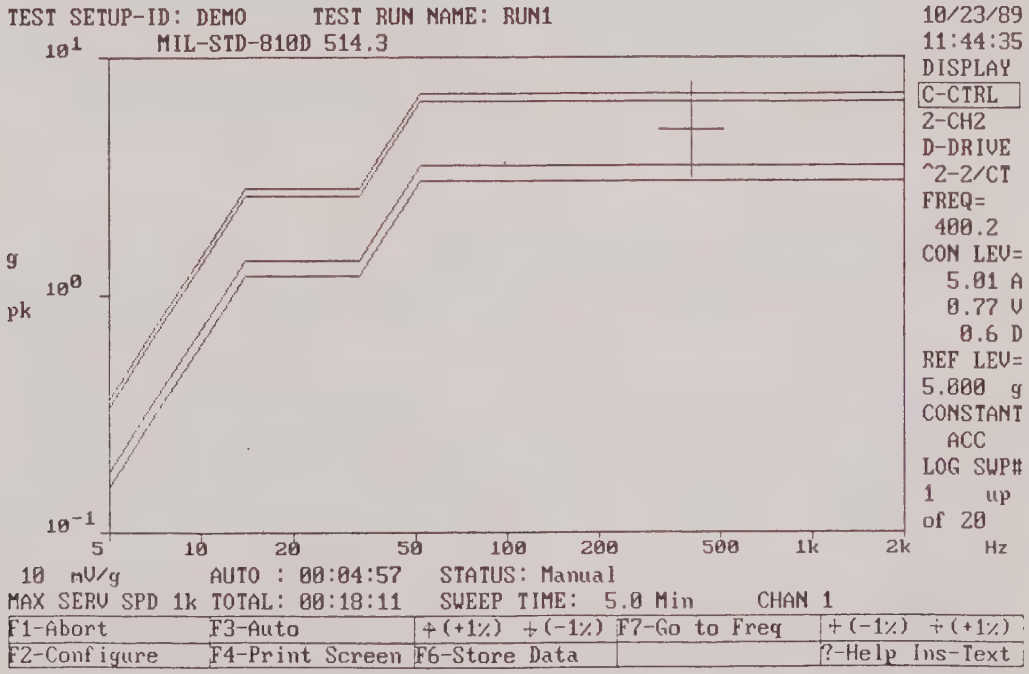
Pressing the UP or DOWN arrow key changes the level by either + or - 1%, but in no case will the level be allowed to exceed the upper abort limit or be less than 10% of the reference level (-20 dB). Pressing (Shift) simultaneously with the UP or DOWN arrow key causes changes of + or - 10%.

Pressing the LEFT or RIGHT arrow key causes the frequency to decrease or increase by a small amount. The vibration level maintains the preexisting ratio with respect to the reference level. Pressing (Shift) simultaneously with an arrow key causes the frequency to change by a much larger amount.

A new function key is active in the MANUAL Mode. Pressing (F7) produces a prompt asking for a new frequency. After the frequency has been typed and entered, the drive voltage goes to zero beiefly the frequency is changed and the vibration level ramps to the same level relative to the reference level that was established prior to the request for a new frequency.

The display shown in Fig. 4-14 below was obtained after pressing (F5) and then (F7) to change the frequency to 400 Hz (See Fig. 4-2). The grids and the reference level were removed by changing the CONFIGURE Menu.

Fig.4-14



In no case can the operating frequency change to a value outside the boundary values specified in the TEST SETUP.

4.7 LOCAL Mode

The LOCAL Mode allows the operator to control the vibration frequency and level from controls on the front panel of the UD345. In the LOCAL Mode, the AT-400/S is in open loop operation, and no safety limits are provided. Operator care and discretion are very important.

To enter the LOCAL Mode:

1 - Turn the OUTPUT Control CCW to RESET.

2 - Turn the key switch from KEYBOARD to LOCAL with the UD345 key.

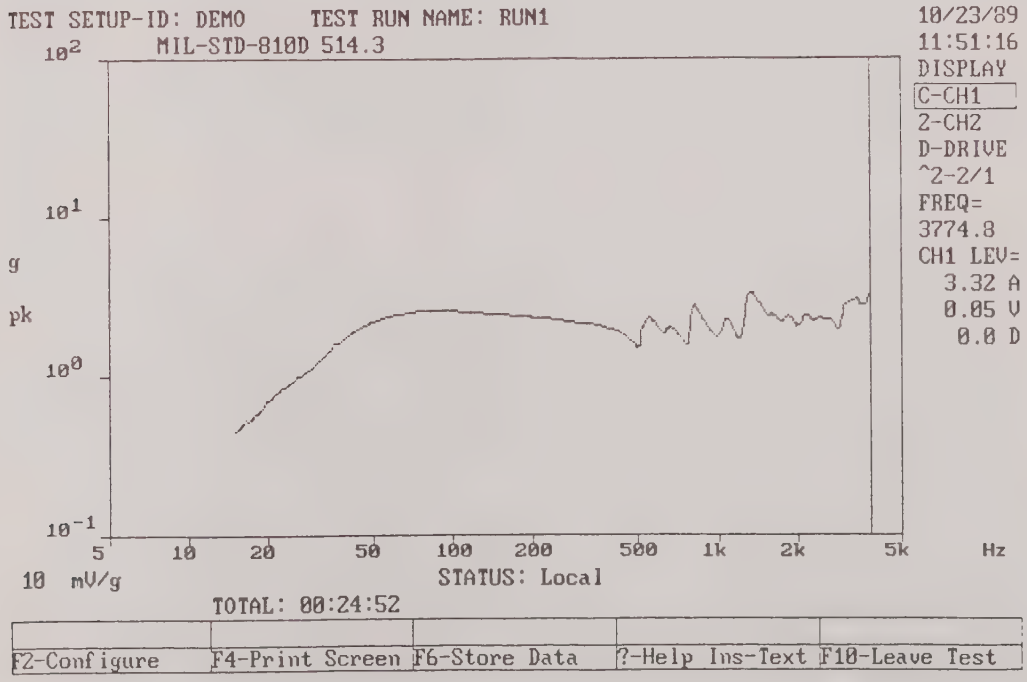
After a short time, the screen is rescaled to show a 5 Hz to 5 kHz frequency range. The vibration amplitude and level are indicated by the plus-shaped cursor.

The drive voltage is controlled, and consequently the vibration level, by the OUTPUT Control. The frequency is adjusted by the COARSE and FINE controls.

The vibration level may be read from the digital meter on the front panel of the UD345 in acceleration, velocity or displacement units, by pressing the button beside the appropriate LED indicator. These buttons are not active except in the LOCAL Mode.

The display in Fig. 4-15 below was obtained by configuring the cursor to the CURSOR TRACE Mode. In the lower frequency portion of the display the OUTPUT was increased initially at about 15 Hz and the frequency was increased slowly for constant drive voltage.

Fig.4-15



Leave the LOCAL Mode by turning the key on the front panel of the UD345 from LOCAL to KEYBOARD. The vibration graph disappears from the screen and the SINE VIBRATION TEST Menu reappears.

4.8 Other CONTROL Keys

When the frequency is sweeping in the AUTO Mode, pressing (F9) causes the sweep to stop and the frequency to hold or remain constant. The vibration level remains at the reference level. Sweeping is resumed by pressing (F9) a second time. Time spent in the AUTO HOLD Mode is not included on the AUTO clock.

When the frequency is sweeping or in the AUTO HOLD Mode, pressing (F7) causes the frequency to sweep in the opposite direction. Each time the sweep is reversed by (F7), the sweep number is incremented.

4.9 Average Control (Option)

For those systems in which the average control option has been supplied, a number of comments concerning the operation and flexiblity of the system are offered in this section.

First of all, the test setup DEMO printed on Page 4-2 was edited to accommodate three input channels. The line item below was changed as shown:

CONTROL CHANNEL INPUT SEQUENCE..> 1,2,3, , , , ,

The control signal for constant acceleration control segments is the multiplexed signal for a channel sequence of 1,2,3. For constant displacement and constant velocity segments in the test setup, the control signal is changed to the first channel in the sequence designation (i.e. Channel 1).

Single channel control is required for constant D or V segments because a wide-band controller is required for sine-average control using a multiplexer. Integration of a multiplexed control signal can actually create frequencies in the integrator output which do not occur in the original control signals, thus causing incorrect control amplitudes.

Requiring control from a single channel for constant D and V control segments is not really a serious objection. This restriction has been used successfully for over two decades because practically all of the constant D or V control segments occur at low frequencies where there are few resonances, and a single control channel can be used effectively.

The amplitude of the Control signal is shown near the end of the first sweep in Fig. 4-16. The grids and the reference curve have been suppressed by reconfiguring the graph.

Data for the acceleration signals of Channels 1, 2 amd 3 are also being saved by sequential sampling from a fast AC-DC converter. Pressing (1) displays the graph shown in Fig. 4-17 for Channel 1.

Fig.4-16

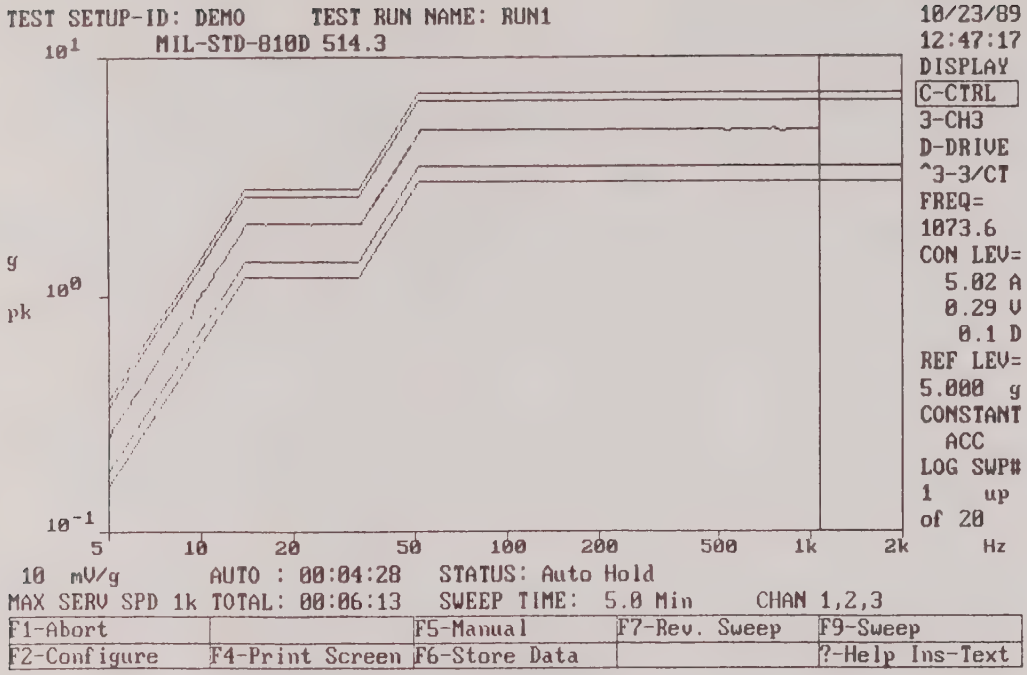
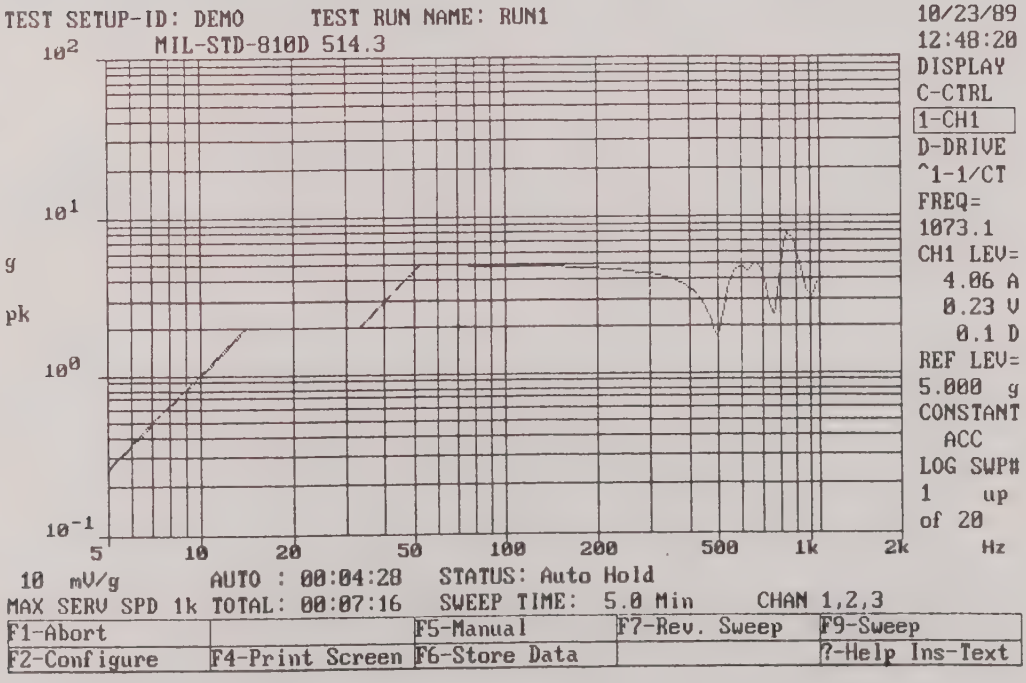


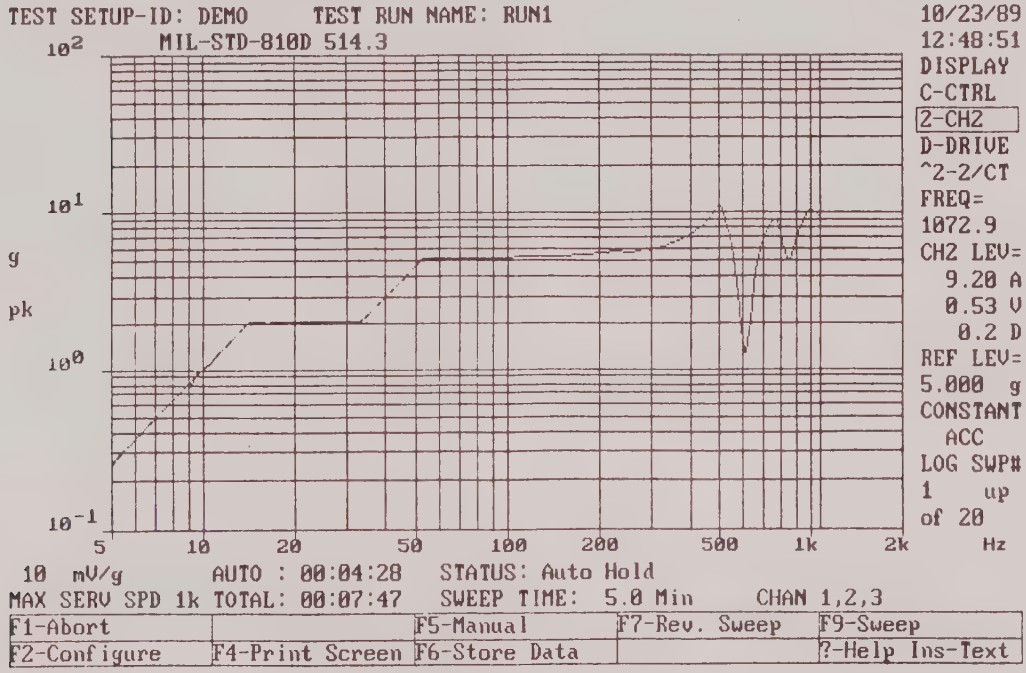
Fig.4-17



To obtain the graph for Channel 2, press (2) to obtain the display in Fig. 4-18. If the sweep rate is too rapid multiplexing the AC-DC converter output may cause recording errors, particularly

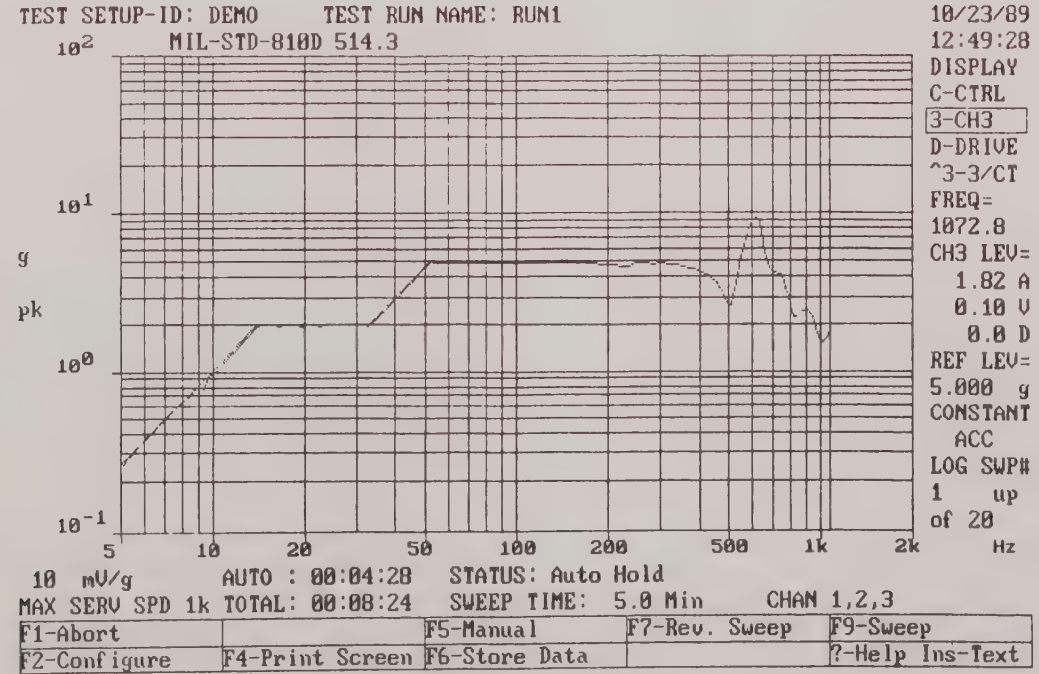
at low response levels. In that case, do not specify an ANALYSIS SAMPLING SEQUENCE in the TEST SETUP menu and use the keyborad to select the analysis channel for separate sweeps to obtain data.

Fig.4-18



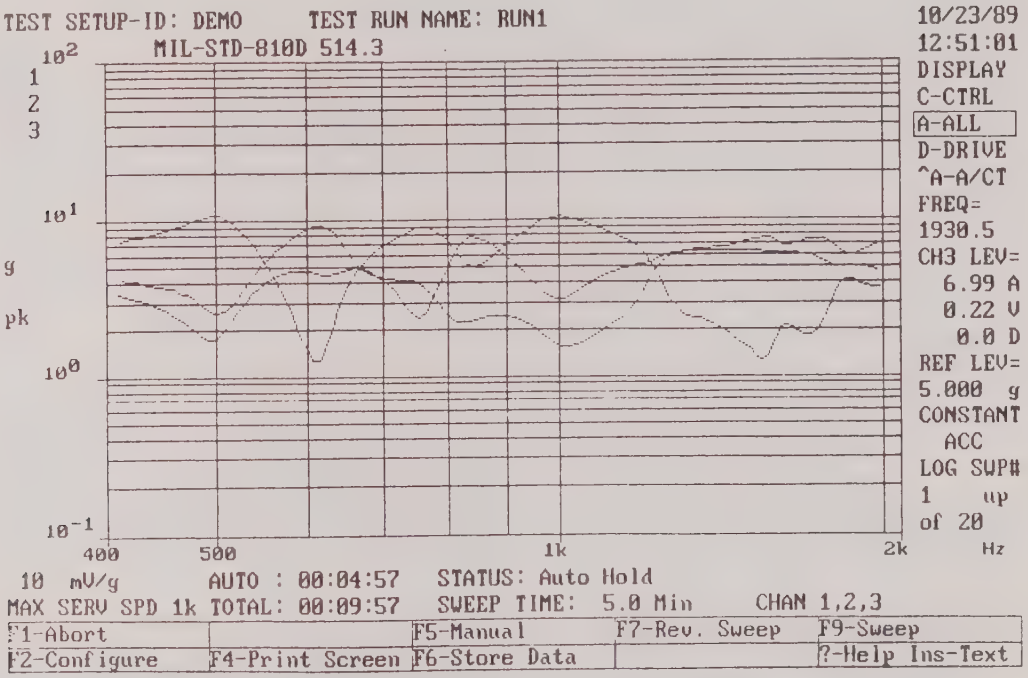
In a similar fashion, press (3) to obtain the graph for Channel (3) shown in Fig. 4-19.

Fig.4-19



After reconfiguring the Analysis display to zoom frequency between 400 and 2000 Hz, press (A) to display all responses simultaneously. The result is shown in Fig. 4-20.

Fig.4-20



From the displays shown in Figs. 4-16 through 4-19 it is easily seen that resonant effects are evident above 200 Hz. At any frequency, if data from all three channels are averaged, the result should be the control acceleration (5g). For example, at the cursor frequency of approximately 1073 Hz and using the measured acceleration values from Figs. 4-16, 4-17 and 4-18, we have the average computed below:

$$(4.06 + 9.20 + 1.82)/3 = 5.03g$$

One further comment is necessary. If resonance effects are noticeable at a crossover from a D or V-segment to an A-segment, or vice versa, the test may be stopped due to exceeding the abort limits near the crossover frequencies.

Consider the situation in which the amplitude of the control channel acceleration for a D-control segment just before crossover is considerably less than the controlled amplitude of that same acceleration for an A-segment just after crossover. This could happen if the acceleration(s) for the other control channels for the A-segment are much less than the one chosen for D-segment control (due to specimen resonances).

When crossover from D to A occurs, the control signal switches suddenly from a single channel to a multiplexed signal and

amplitude of the control signal suddenly decreases. The action of the AGC circuit causes the control signal to increase to the proper level, but not before the negative going amplitude is recorded. The action occurs in the opposite fashion if the crossover is from A to D for the reverse direction sweep. If the abort limits are too close, they will be exceeded and the test will be stopped.

Two possible remedies are possible for this seldom occurring situation:

1 - Widen the abort limits
2 - Change the CONTROL CHANNEL INPUT SEQUENCE so that the single channel acceleration selected for D or V control is close to the average acceleration for A control near the crossover frequency.

4.10 Extremal Control (Option)

If the Extremal Control Option is supplied then an additional line item appears on the SINE TEST SETUP Menu below the CONTROL CHANNEL INPUT SEQUENCE:

```
CONTROL CHANNEL INPUT SEQUENCE.>1,2,3, , , , ,
    <N=CHN FOR N=1-8>
MULTI CHANNEL CONTROL STRATEGY:>2
    <1=AVERAGE,2=EXTREMAL>
```

For Extremal Control, (2) is entered in the Menu. The EXTREMAL CONTROL TABLE also is added to the Menu, after all the individual line items have been entered:

SETUP ID : DEMO EXTREMAL CONTROL TABLE

CHANNEL NUMBER	TYPE (%,g)	CONTROL LEVEL (% of reference or g)	FREQUENCY RANGE (Hz) LOW	HIGH
1	%	100	5	2000
2	%	300	5	2000
3	%	150	5	2000

In the entries shown above it was assumed that Channel 1 was the primary control channel and channels 2 and 3 should only exert control if the resonant responses attempted to exceed 300% and 150%, respectively, of the primary control level. These control limits were exercised over the entire frequency range from 5 to 2000 Hz.

Fig. 4-21 is the first HELP page available for the EXTREMAL CONTROL TABLE.

```
        TEST SET UP Line Item Descriptions - EXTREMAL CONTROL TABLE

Most of the line items have default entries with commonly occurring values or
choices. They may be overwritten.

        The following apply for the EXTREMAL CONTROL OPTION.

 CHANNEL NUMBER - The channel numbers that were entered in the CONTROL CHANNEL
     INPUT SEQUENCE will be listed in this column. They cannot be changed
     from this table.

 TYPE - Enter % to specify the CONTROL LEVEL as a percent of the level(s) in
     the PROGRAM TABLE, or g (a when using metric units) to specify the
     CONTROL LEVEL as a constant acceleration level.

 CONTROL LEVEL - Enter the reference level for this channel. All channels in
     this table will be controlled so that none is above its reference level.

 FREQUENCY RANGE - Enter the range in which the limits on this line will
     apply.


         PgDn - to continue      Esc - back to menu
```

Fig.4-21

The LIMIT CHANNELS Table is also added to the TEST SETUP Menu for the Extremal Control Option:

SETUP ID : DEMO LIMIT CHANNELS

ENTRY NO.	CHANNEL NUMBER	TYPE (%,g)	ALARM (+)	ALARM (-)	ABORT (+)	ABORT (-)	FREQUENCY RANGE (Hz) LOW	FREQUENCY RANGE (Hz) HIGH
1		%						

No entries have been made for this Table, making it inactive. Note, however, from the HELP pages appearing in Figs. 4-22 and 4-23, that the entries provide appropriate audible alarm or abort action when the individual channel responses deviate from the program level by specified amounts in both directions.

After changing the SWEEP TIME to 10 min., (F10) was pressed to return to the SINE TEST SETUP Menu, and F(7) was pressed to begin the test.

Following the usual procedure for starting the test in the AUTO Mode, (F9-Auto Hold) was pressed near the end of the sweep. The frequency axis was reconfigured to ZOOM from 200 to 2000 Hz. The response graphs for Channels 2 and 3 were displayed by pressing (2) and then (3). These are shown in Figs. 4-24 and 4-25.

TEST SET UP Line Item Descriptions - LIMIT CHANNEL TABLE

Many of the line items have default entries with commonly occurring values or choices. They may be overwritten.

CHANNEL NUMBER - Enter the number of a channel on which the limits will apply. The channel must have been specified in the ANALYSIS CHANNEL SAMPLING SEQUENCE. To limit the Drive voltage, enter D instead of a number.

TYPE - Enter % to specify the ALARM and ABORT levels as a percent above (+ column) or below (- column) the PROGRAM TABLE reference levels, or g to specify the limits as a constant acceleration level. If D for Drive has been entered in place of the channel number, V will appear here to indicate rms drive voltage.

Note that when using extremal control, any limits specified as % are relative to the levels specified in the PROGRAM TABLE, even if a different level was entered for this channel in the EXTREMAL CONTROL TABLE.

PgDn - to continue Esc - back to menu

Fig.4-22

TEST SET UP CONTROL KEYS

ALARM - An alarm will sound when the level on this channel exceeds the level in the (+) column or is less than the level in the (-) column.
ABORT - The test will abort when the level on this channel exceeds the level in the (+) column or is less than the level in the (-) column.

Any ALARM or ABORT entry in this table may be left blank.

FREQUENCY RANGE - Enter the range for which the limits on this line will apply.

Ins - Allows new channel entries at the cursor location without destroying existing entries.

Del - Deletes channel entry at the cursor location, and leaves remaining entries in order.

Esc - Exits the setup without storing changes. A "Y" answer to the subsequent prompt verifies that this is the true intent of the operation. An "N" answer cancels the Esc command.

PgUp - back up one screen PgDn - forward one screen Esc - back to menu

Fig.4-23

Fig.4-24

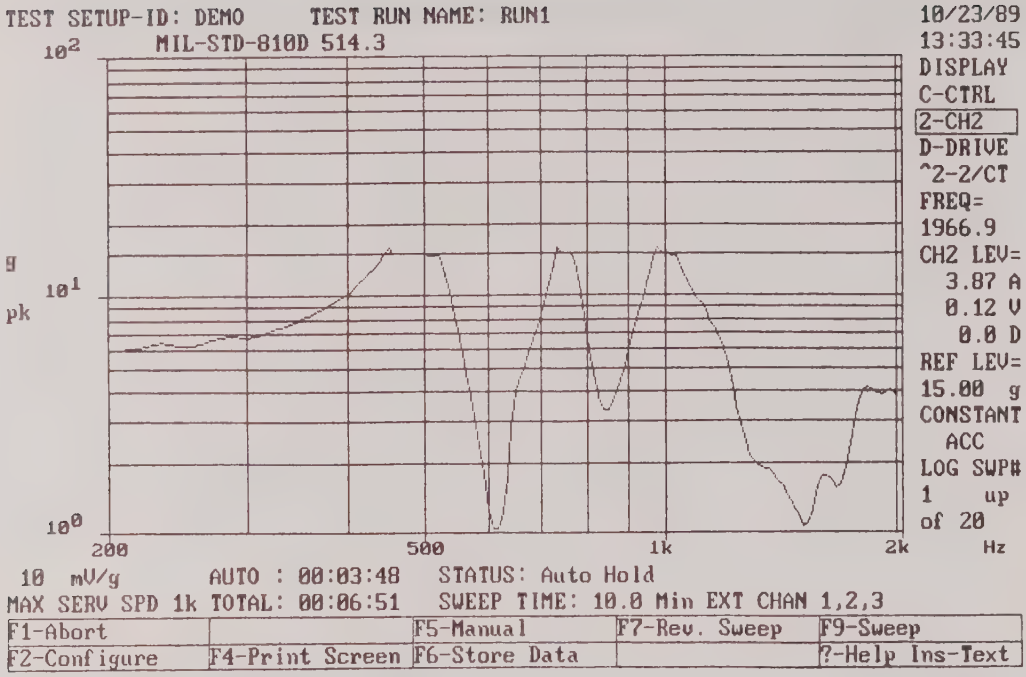
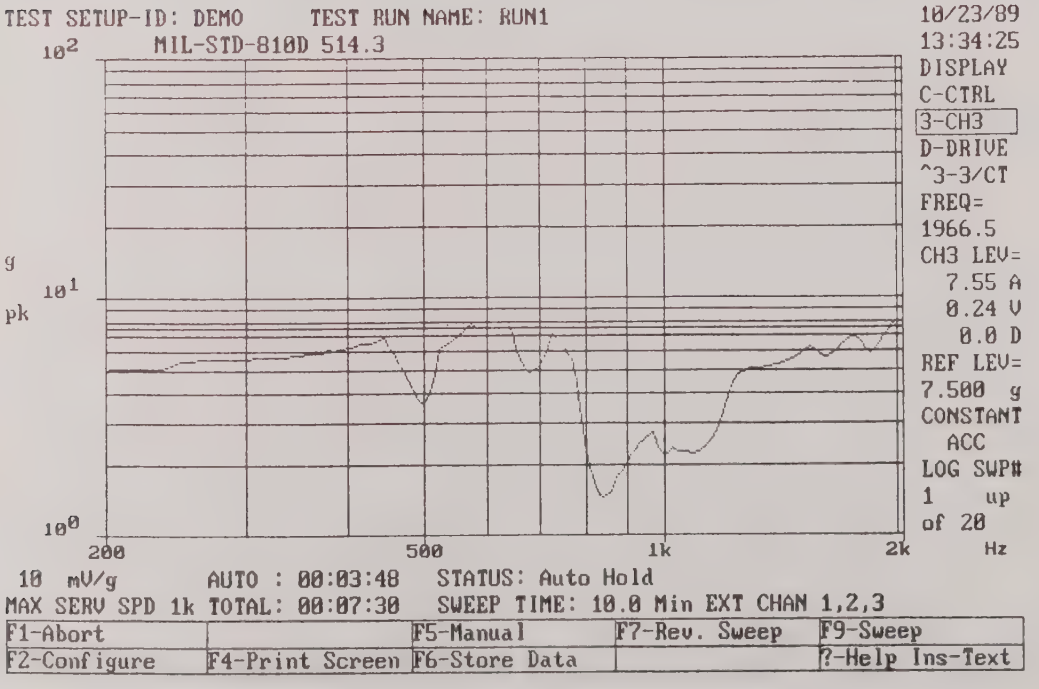


Fig.4-25

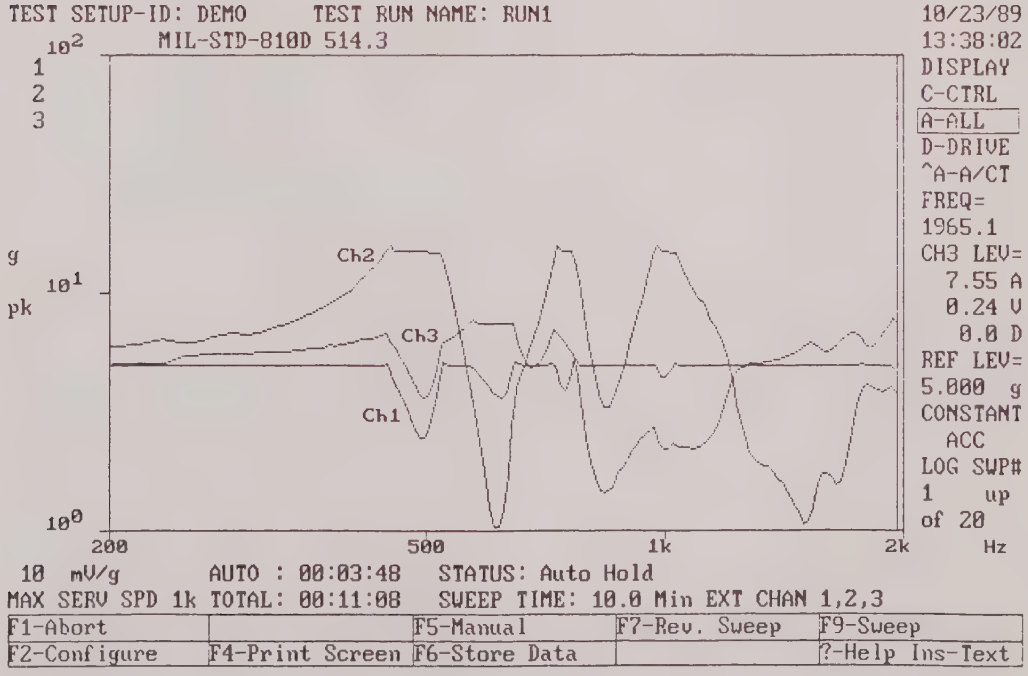


Note that Channel 2 shows limiting control action in the vicinity of 500, 750 and 1000 Hz at 15g. The reference (green) control spectrum is plotted at 300% of the reference graph for Channel 1. Channel 3 shows limiting action in the vicinity of 600 Hz at 7.5g and the reference control spectrum is plotted at 150% of that for Channel 1.

After the analysis channel is reconfigured to remove grid lines and reference graphs, (A) is pressed to display all three channels simultaneously as shown in Fig. 4-26. Note that whenever Channel 2 or Channel 3 is in control, Channel 1 acceleration falls below the 5g control level, as expected. There are also slight overshoots at the transition levels which are due to the finite delays necessary due to multiplexing and monitoring the DC levels in each channel. These overshoots get larger as more channels are compared or the sweep time is shorter.

Text was also inserted in Fig. 4-26 to mark "Ch 1", "Ch 2" and "Ch 3" and to demonstrate the use of the (Ins) CONTROL KEY for entering the ANNOTATE Mode (See Fig. 4-3).

Fig.4-26



5. SAVING AND RETRIEVING DATA

5.1 Introduction

To demonstrate the capability of the 400AT/S for storing and retrieving data, the test setup on page 4-2 will be run.

With the SINE VIBRATION TEST Menu displayed,
Press (F7) to obtain the four queries below the Menu shown in Fig.5-1.
Confirm or enter the four responses shown.

Fig.5-1

```
                        SINE VIBRATION TEST          ver: 10/20/89

F1 = TEST SETUP                          F2 = TEST SEQUENCE SETUP

F3 =                                     F4 = CONFIGURE GRAPH COLORS

F5 = TEST DATA                           F6 = TEST SEQUENCE DATA

F7 = RUN TEST                            F8 = RUN TEST SEQUENCE

F9 =                                     F10 = EXIT TO PREVIOUS MENU

RUN TEST SETUP-ID.............: DEMO
ENTER RUN NAME................: RUN1
SAVE DATA AUTOMATICALLY?......: 1
     <1=FIRST AND LAST SWEEP,2=ALL SWEEPS,3=LAST SWEEP,4=NO>
ANALYSIS CHANNEL SAMPLING SEQ : 1,2,3, , , , ,

     Esc (Back to Menu)      Enter (Accepts Entry)
```

The general procedures in this chapter are almost identical with those for the 400AT/R for random vibration testing. The reader who is familiar with those procedures will probably be satisfied with a quick review of the following material.

5.2 Running the Test

The test is initiated by (F3) after the final entry for the display in Fig. 5-1 is confirmed.

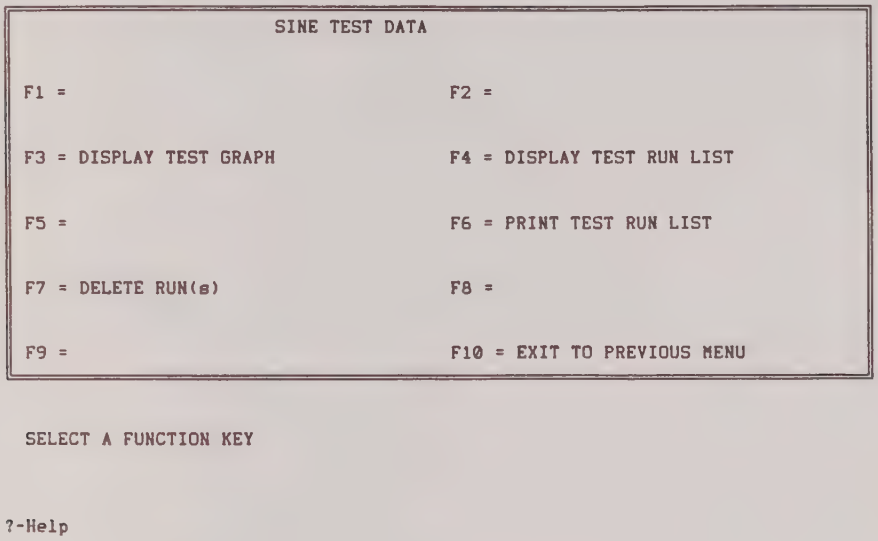
After 00:02:44 of the test run has elapsed, (F6) is pressed causing the host to store data for Data Set 1. The red LED on the host computer shows that the data save is being accomplished. After the first sweep is completed at 00:04:59, the red LED again shows that the automatic data save requested is being accomplished for Data Set 2.

Since the DEMO test was programmed for twenty sweeps, pressing (F1) causes the test to abort and provides another automatic data save, for Data Set 3. Pressing (F10-LEAVE TEST) causes the SINE VIBRATION TEST Menu to be displayed again.

5.3 Retrieving the Data

Press (F5-TEST DATA) to provide a display of the SINE TEST DATA Menu shown below in Fig. 5-2.

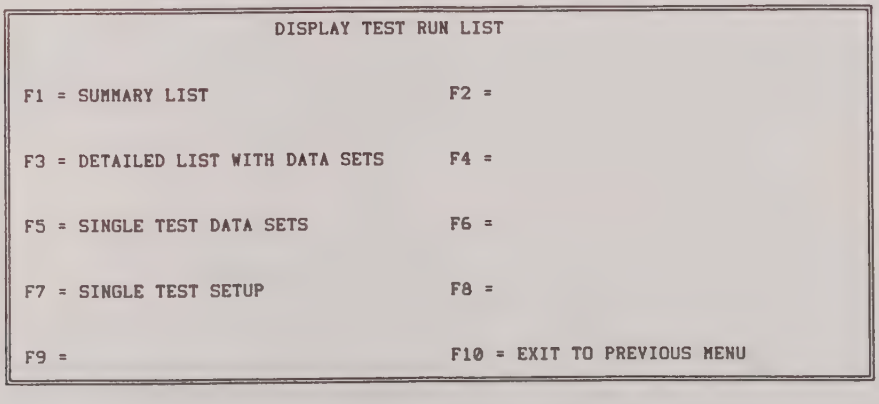
Fig.5-2



In actual practice considerable time may have elapsed since the running of the test and the reviewing of the data, so it may be necessary to refresh our memory before we decide to press (F3-DISPLAY TEST GRAPH).

Press (F4) to provide a display of the DISPLAY TEST RUN LIST Menu shown in Fig. 5-3. If additional information is needed, press (Shift, ?) to display HELP messages.

Fig.5-3



Press (F1) to display a list of TEST SETUP 1D's and associated RUN NAMES for which data has been saved. The date and time the TEST SETUP was last edited and the date and time of the beginning of each test run is also displayed. Scrolling the display by pressing any key repetitively produces the display for DEMO which is shown in Fig. 5-4. The entry for RUN 1 confirms the data save of interest to us.

Fig.5-4

SUMMARY LIST OF TEST SETUP and RUN NAMES

TEST SETUP ID	DATE	TIME	RUN-NAME	DATE	TIME
1 CALSINE					
1	04/03/87	08:46:09	RUN1	09/28/89	10:44:47
2	04/03/87	08:46:09	RUN2	09/28/89	17:28:47
3	04/03/87	08:46:09	RUN3	09/29/89	11:35:26
2 DANTEST					
1	10/17/89	15:40:47	RUN1	10/18/89	08:39:50
3 DEMO					
1	10/24/89	14:29:23	RUN1	10/24/89	14:34:22
4 LEE1					
1	09/28/89	09:22:15	RUN1.001	09/28/89	09:29:22
5 LEE2					
1	09/28/89	09:22:51	RUN1.002	09/28/89	09:45:26
6 LEE3					
1	09/28/89	09:24:44	RUN1.003	09/28/89	10:02:12
7 LEE4					
1	09/28/89	09:26:15	RUN1.004	09/28/89	10:12:02

Press (Esc) to return to the DISPLAY TEST RUN LIST Menu and then press (F5). Enter or confirm (DEMO) and enter or confirm (RUN 1) in response to the queries that appear below the menu as shown in Fig. 5-5.

The list shown in Fig. 5-6 is immediately displayed, and shows the DATA SETS saved when RUN 2 was made earlier. The time in the AUTO TEST mode is listed along with the total test time, the current status, sweep number and direction and the current active measurement/analysis channels.

Fig.5-5

DISPLAY TEST RUN LIST

F1 = SUMMARY LIST F2 =

F3 = DETAILED LIST WITH DATA SETS F4 =

F5 = SINGLE TEST DATA SETS F6 =

F7 = SINGLE TEST SETUP F8 =

F9 = F10 = EXIT TO PREVIOUS MENU

LIST TEST SETUP-ID.....: DEMO
ENTER RUN NAME.....: RUN1

Fig.5-6

LIST OF TEST SETUP and RUN NAMES

TEST SETUP ID	DATE Data Set	TIME Auto Time	RUN-NAME Total Time	Status	Sw. no.	DATE Dir.	TIME Channel
1 DEMO							
1	10/24/89	14:29:23	RUN1			10/24/89	14:34:22
	1	00:02:44	00:02:52	Auto	1	up	1,2,3
	2	00:04:59	00:05:07	Auto	1	up	1,2,3
	3	00:05:03	00:05:11	Abort	2	down	1,2,3

Press (Esc) - return to DISPLAY TEST RUN LIST Menu.
Press (F10) - return to SINE TEST DATA Menu.
Press (F3) - causes queries to appear below menu, as shown in Fig. 5-7.
Confirm or enter (DEMO).
Confirm or enter (RUN 1).

Fig.5-7

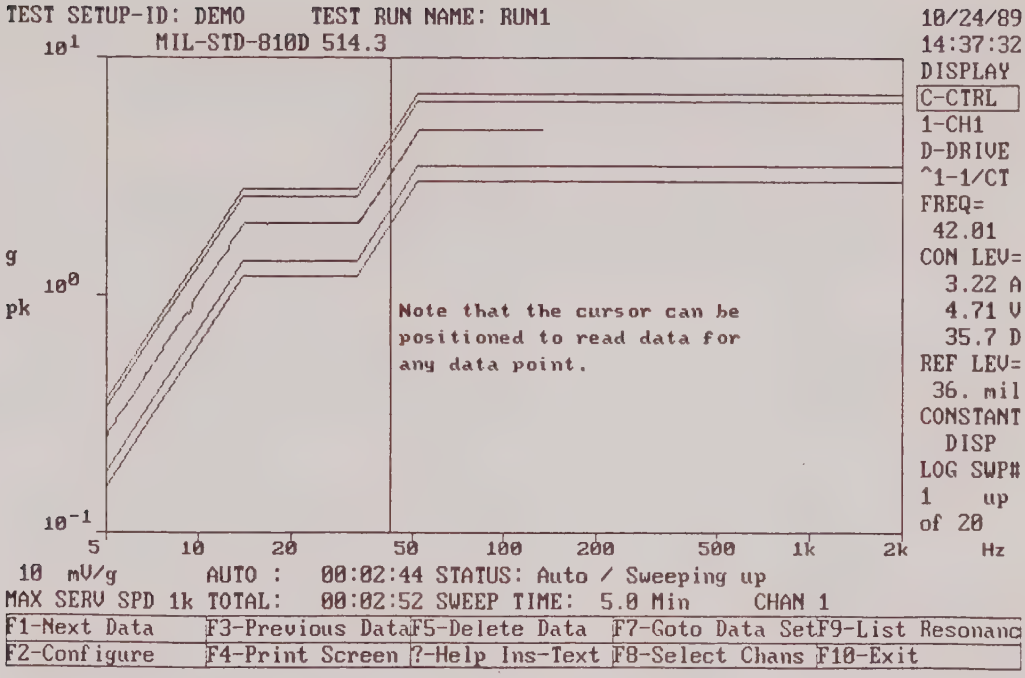
SINE TEST DATA

F1 =	F2 =
F3 = DISPLAY TEST GRAPH	F4 = DISPLAY TEST RUN LIST
F5 =	F6 = PRINT TEST RUN LIST
F7 = DELETE RUN(s)	F8 =
F9 =	F10 = EXIT TO PREVIOUS MENU

DISPLAY TEST SETUP-ID : DEMO
ENTER RUN NAME.....: RUN1

The last entry shown in Fig. 5-7 causes the CONTROL channel data for DATA SET 1 to be displayed. For clarity, the resulting graph shown in Fig. 5-8 is reconfigured by pressing (F2) to eliminate the grid lines, and the reference graph. The cursor has also been positioned to show an intermediate data point. Note that the TEXT ANNOTATION feature has been used to insert a message on the graph.

Fig.5-8



Several other graphs could be viewed by typing (2), (3), (A), (D), (Alt,2), or (Alt,3). Pressing (F1) causes the CONTROL channel data for the next data set (#2) to be displayed as shown in Fig. 5-9. However, when the stored number of data sets is numerous, it may be desirable to press (F7) and respond with a desired data set number to skip to the desired set.

Fig.5-9

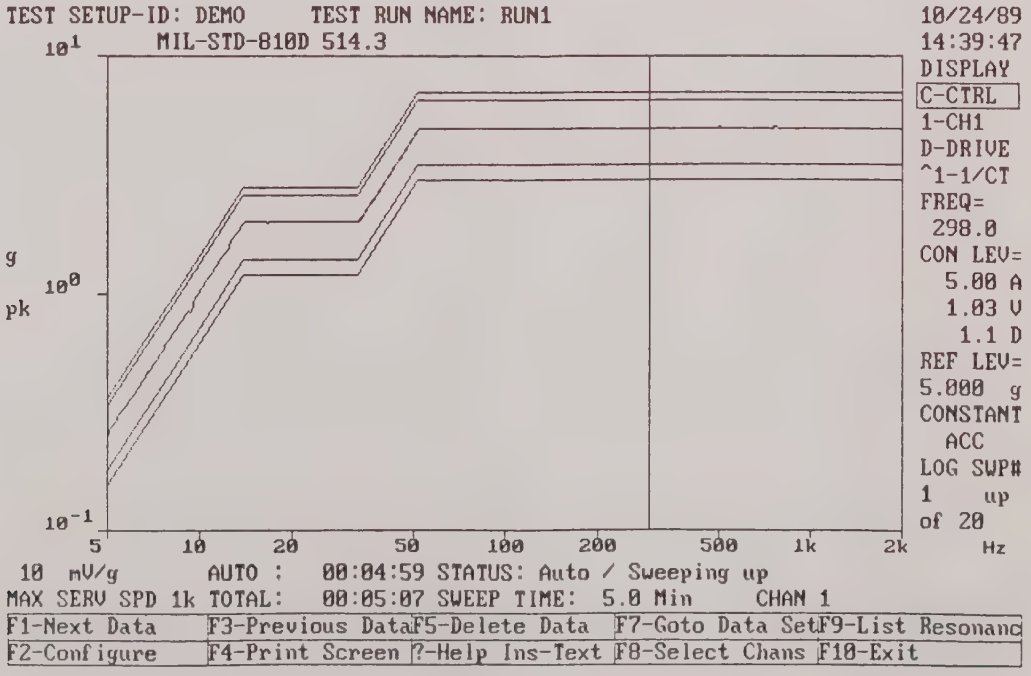
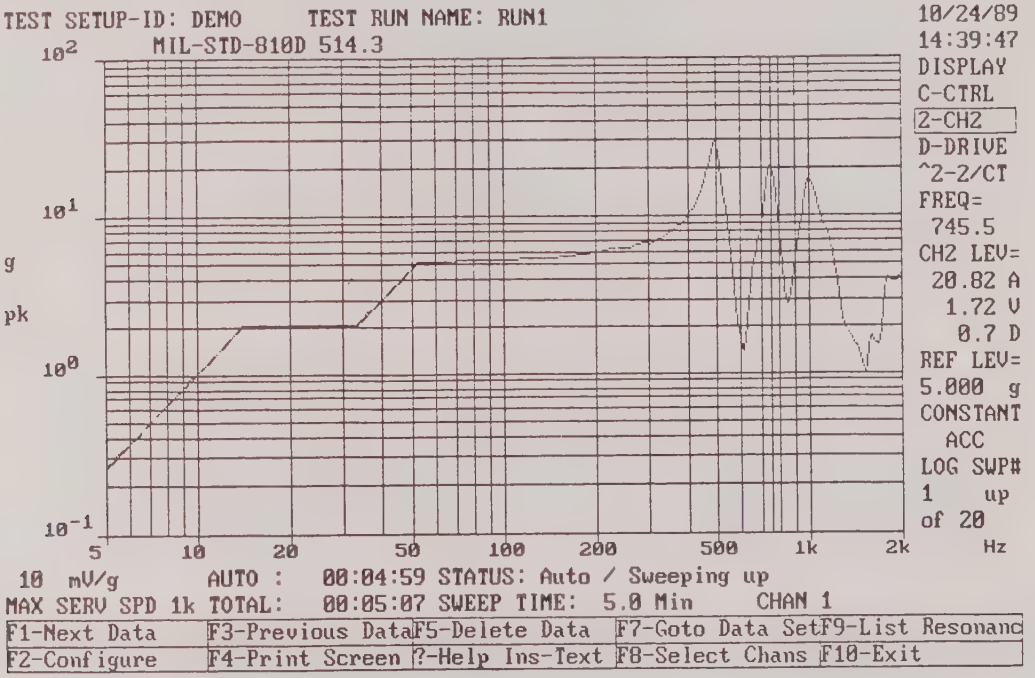


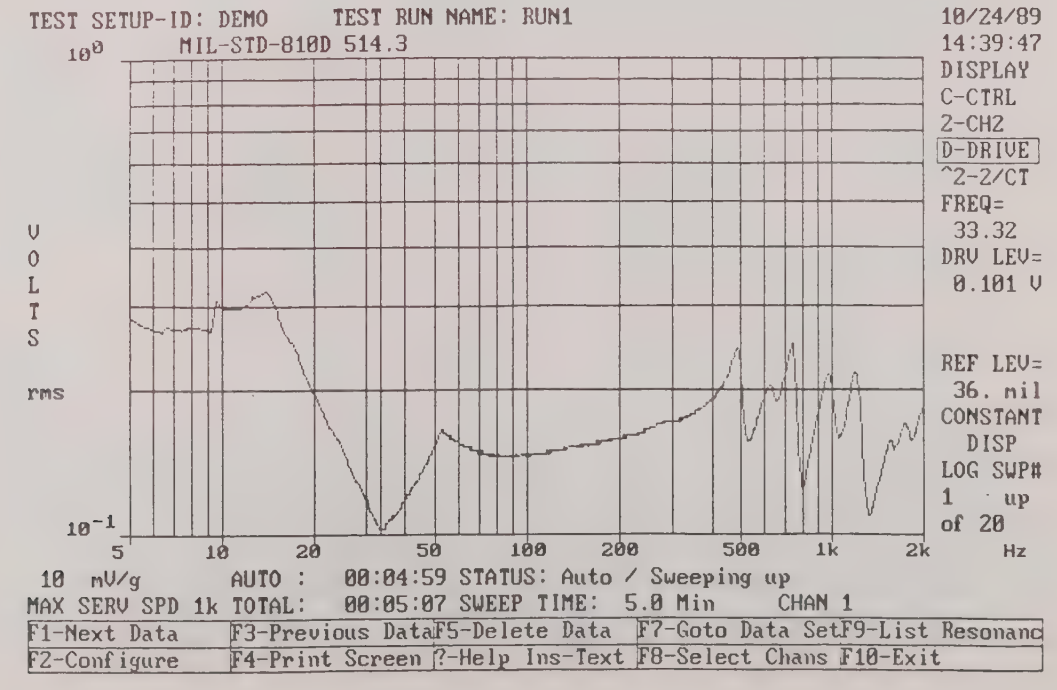
Fig. 5-9 has been reconfigured to eliminate the grid lines and reference acceleration. Pressing (2) displays the acceleration vs frequency for Channel 2, shown in Fig. 5-10. The cursor has been positioned at the maximum response point at 745.5 Hz.

Fig.5-10



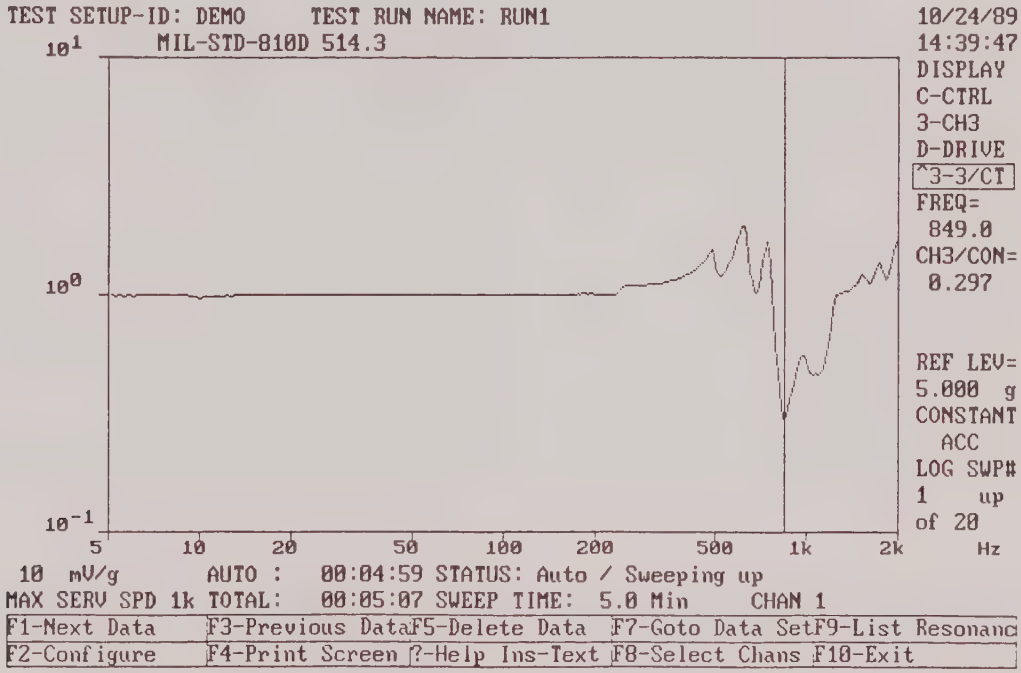
The graph for drive voltage vs frequency is displayed by pressing (D) and is shown in Fig. 5-11. The cursor is placed at the minimum response frequency, 33.32 Hz, at an A-D control crossover.

Fig.5-11



Finally, the transfer ratio of Channel 3 acceleration to Control channel acceleration is displayed by pressing (Alt, 3). The graph shown in Fig. 5-12 is reconfigured to clearly show the unity response at low frequencies and the minimum response for the cursor position at 849.0 Hz.

Fig.5-12



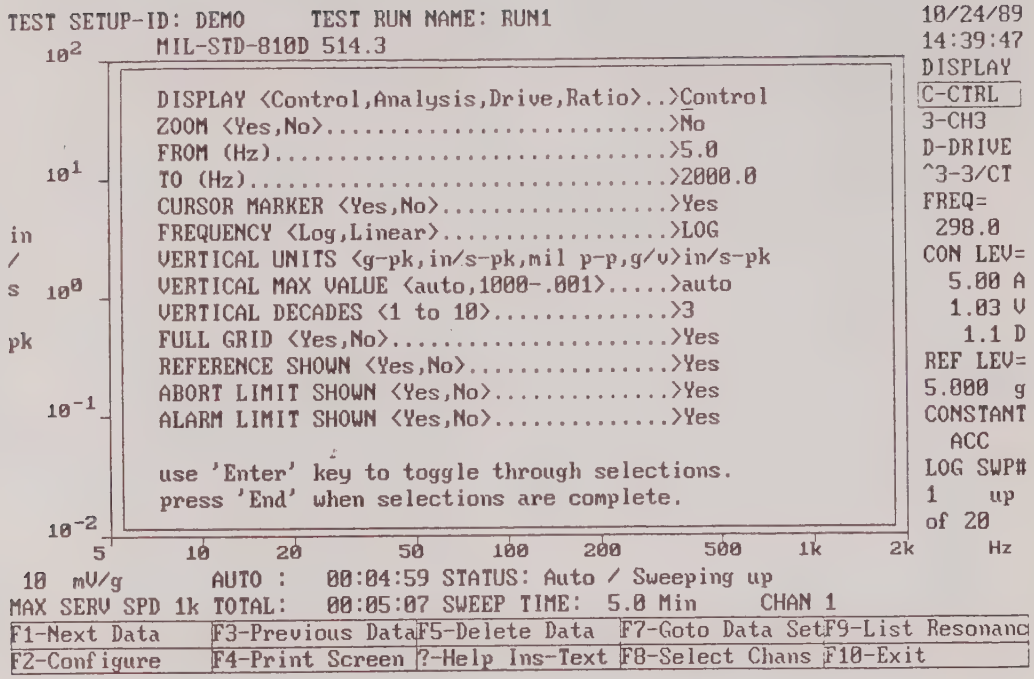
For systems with the Average Control Option, as has been assumed here, as many as eight input channels may be selected for the analysis measurement channel, by multiplexing channels to the AC-DC converter and reading each channel response sequentially. If sequential analysis channels are not chosen in the TEST SETUP, then the active analysis channel must be manually changed at appropriate times during the actual TEST to gather data for all active input channels.

5.4 Changing the Configuration of Data Graphs

Several data graphs (Figs. 5-8, 5-9 and 5-12) were reconfigured to make the essential portions more distinct. The reconfiguration operation for data graphs is identical to that for test graphs. One mode of reconfiguration which is different from those for random vibration testing graphs deserves further illustration.

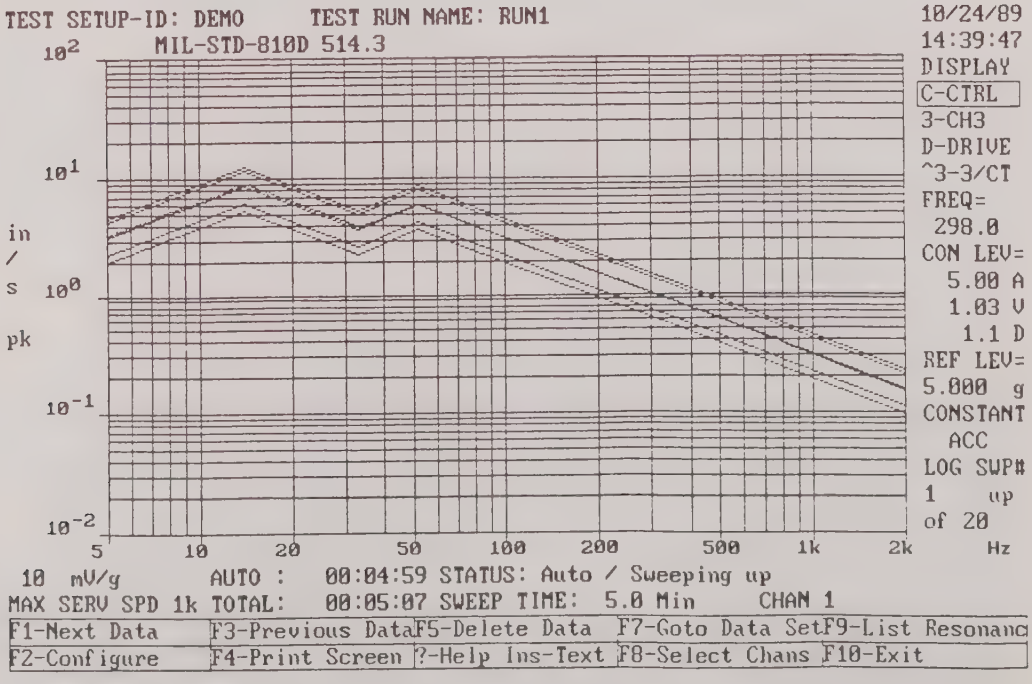
Pressing (F2) displays the configuration parameters which are reproduced in Fig. 5-13. Moving the cursor to VERTICAL UNITS and toggling ENTER until (in/s-pk) appears allows the CONTROL display to be plotted in terms of velocity. A displacement display could also be obtained.

Fig.5-13



Pressing (END) reconfigures Fig. 5-9 to Fig. 5-14, shown below. Note that the grid and reference velocity have been reinserted.

Fig.5-14



5.5 Summary

All data saves that are initiated by the response to the SAVE TEST DATA ? query at the beginning of each test run (See Fig. 5-1) are accomplished when the 400AT/S is in the AUTO mode only. These automatic data saves are made only at the end of a sweep and include all data since the beginning of the sweep.

Should the system abort for any reason, an automatic data save is also made providing that a response for automatic data saves is made initially (See Fig. 5-1). The previous illustrations did not show any of the possible data graphs available from DATA SAVE 3 (See Fig. 5-6) when the (F1) FUNCTION KEY was pressed in the test example.

A data save made by a (F6) command in the middle of a sweep when the system is in the AUTO mode saves data only since the beginning of that sweep. When the system is in the MANUAL mode or the LOCAL mode, data can be saved only by the (F6) command, and then only if the graph has been configured to produce a cursor trace. The number of saved data points is limited to 4096 and data points are saved at an approximate rate of 6 per second.

6. COPYING OPERATIONS

Obtaining periodic copies on floppy disks of important TSET SETUP information, TEST SEQUENCES and saved TEST DATA from the system hard disk is an important part of system operation. This BACKUP operation can save many hours of reconstructive labor, should important information be inadvertently deleted from the hard disk. The complementary or RESTORE operation occurs when files on floppy disks are recopied to the system hard disk. The organization and techniques of making such copies are described in this chapter.

Obtain the MAJOR OPERATIONAL MODES Menu below:

```
                    MAJOR OPERATIONAL MODES

F1 = RANDOM TEST                    F2 = REMOTE/KEYBOARD

F3 = SINE TEST                      F4 = MEASUREMENT/ANALYZE

F5 =                                F6 = MAINTENANCE/CONFIGURATION

F7 = SHOCK TEST                     F8 = HELP

F9 =                                F10 = EXIT
```

SELECT A FUNCTION KEY

Press (F6) to obtain the MAINTENANCE/CONFIGURATION Menu below:

```
                    MAINTENANCE/CONFIGURATION     ver: 10/05/89 11:34:02

F1 = HARDWARE CONFIGURATION         F2 = OPERATOR ACCESS

F3 = DATE/TIME                      F4 =

F5 = BACKUP                         F6 = RESTORE

F7 = RESET RANDOM RUN COUNTER       F8 = DEFAULT TEST ENTRIES

F9 =                                F10 = EXIT
```

SELECT A FUNCTION KEY

Press (F5) to obtain the BACKUP TYPE Menu shown below. This Menu lists the various types of test methods for which there may be stored information.

BACKUP TYPE	
F1 = RANDOM	F2 =
F3 = SINE	F4 = MEASURE/ANALYZE
F5 =	F6 =
F7 = SHOCK	F8 =
F9 =	F10 = EXIT TO PREVIOUS MENU

SELECT A FUNCTION KEY

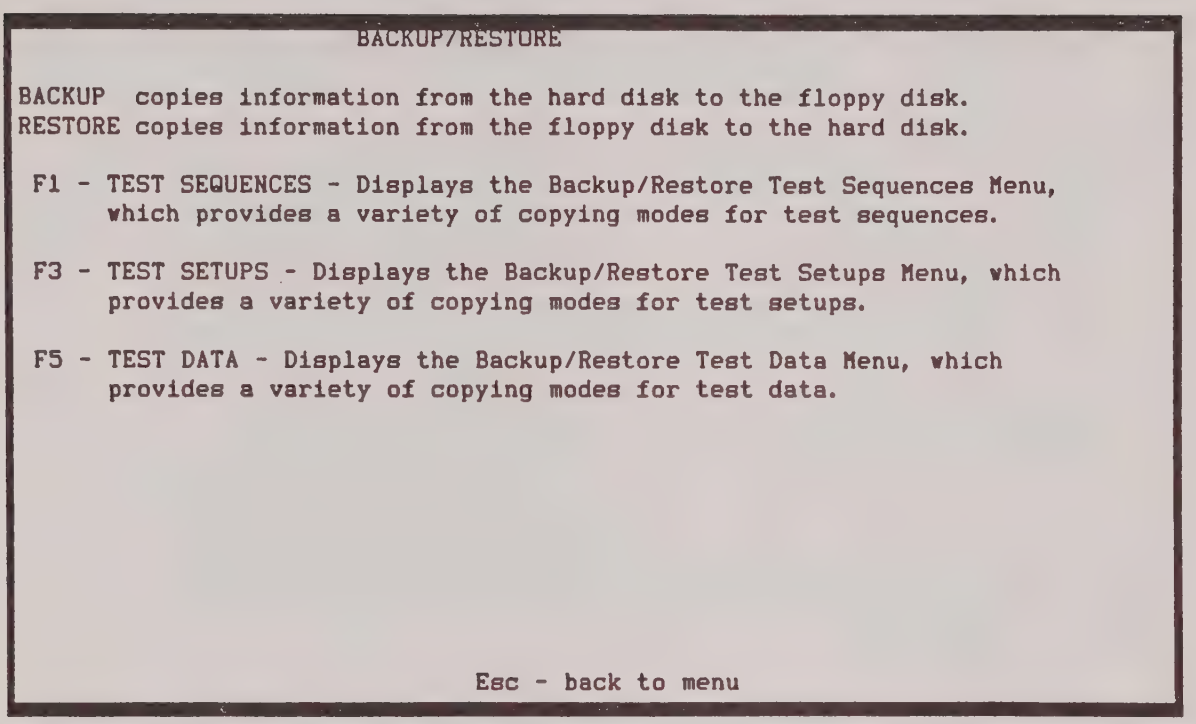
Press (F1) to display the BACKUP RANDOM TESTS Menu below:

BACKUP RANDOM TESTS	
F1 = TEST SEQUENCES	F2 =
F3 = TEST SETUPS	F4 =
F5 = TEST DATA	F6 =
F7 =	F8 =
F9 =	F10 = EXIT TO PREVIOUS MENU

SELECT A FUNCTION KEY

?-Help ---

Press (Shift,?) to obtain the HELP page on p.6-3. it contains a description of the categories of information stored for RANDOM TESTS.


BACKUP/RESTORE
BACKUP copies information from the hard disk to the floppy disk.
RESTORE copies information from the floppy disk to the hard disk.
F1 - TEST SEQUENCES - Displays the Backup/Restore Test Sequences Menu, which provides a variety of copying modes for test sequences.
F3 - TEST SETUPS - Displays the Backup/Restore Test Setups Menu, which provides a variety of copying modes for test setups.
F5 - TEST DATA - Displays the Backup/Restore Test Data Menu, which provides a variety of copying modes for test data.
Esc - back to menu

This HELP display, and all following HELP displays, are common to both BACKUP and RESTORE operations for all types of tests. The menus for all BACKUP and RESTORE operations are identical except for the implied direction of the copying action. If (F6) had been chosen from the MAINTENANCE/CONFIGURATION Menu on p.6-1, all following menus would have had RESTORE instead of BACKUP in their titles.

Similarly, if (F3) had been chosen from the BACKUP TYPE Menu on p.6-2, then all following menus would relate to SINE vibration tests instead of RANDOM vibration tests.

For these reasons, the menus for the RESTORE choice on the MAINTENANCE/CONFIGURATION Menu on p.6-1, and the SINE, SHOCK or MEASURE/ANALYZE choices from either the BACKUP or RESTORE Menus (See p.6-2) will not be reproduced in the remainder of this chapter.

Press (Esc) to return to the BACKUP RANDOM TESTS Menu.
Continue on p.6-4.

Press (F1) to display the BACKUP TEST SEQUENCES Menu below:

```
                    BACKUP TEST SEQUENCES

F1 = COPY ONE SEQUENCE AT A TIME          F2 = DISPLAY SEQUENCE IDS
                                                CHRONOLOGICALLY

F3 = COPY ALL SEQUENCES                   F4 = DISPLAY SEQUENCE IDS
                                                ALPHABETICALLY

F5 = COPY ALL SEQUENCES SINCE ____        F6 = PRINT SEQUENCE IDS
                                                CHRONOLOGICALLY

F7 = COPY ONE SEQUENCE RUN                F8 = PRINT SEQUENCE IDS
                                                ALPHABETICALLY

F9 =                                      F10 = EXIT TO PREVIOUS MENU

 SELECT A FUNCTION KEY

?-Help
```

Note that these operations relate to RANDOM TEST SEQUENCES only.

Press (Shift,?) to obtain the common HELP displays on p.6-5

BACKUP/RESTORE TEST SEQUENCES MENU

Copying action is initiated by F1,F3,F5 or F7. To help the operator decide on appropriate copying action, lists of all test sequence IDs are presented by F2,F4,F6 and F8, along with the approximate number of sequences that may be stored on each disk.
After selecting either F1,F3 or F5, the operator must decide whether or not to copy all test setups listed by the sequence(s) he has decided to copy. A copy of the sequences merely provides a list of the test setup IDs associated with each sequence and not the test setup parameters. In order to include enough information to actually perform test sequences it is necessary to copy the test setups also.

F1 - COPY ONE SEQUENCE AT A TIME - Enter the appropriate test sequence ID, and respond to the additional question outlined above.

F3 - COPY ALL SEQUENCES - Respond to the additional question outlined above.

F5 - COPY ALL SEQUENCES SINCE _____ - Enter the appropriate date and respond to the additional question outlined above. This is valuable for periodic backup operations.

PgDn - to continue Esc - back to menu

Press (PgDn) to display the final HELP page below:

BACKUP/RESTORE TEST SEQUENCES MENU

F7 - COPY ONE SEQUENCE RUN - Allows copying of all data saved during one run of a sequence. Enter the test sequence ID and the run name. The appropriate run numbers (.001, .002, etc.) will be automatically added to this run name to copy the saved data for each test run in the sequence.

If a floppy disk fills up in the middle of copying a group of files (BACKUP action), the operator is asked to insert a new disk and the copying action will continue after a prompt to format or not to format. Formatting initializes a disk and destroys all data on the disk. New disks need to be formatted before they can be used.

PgUp - back up one screen Esc - back to menu

Press (Esc), then (F10) to return to the BACKUP RANDOM TESTS Menu on p.6-2. Continue on p.6-6.

Press (F3) to obtain the BACKUP TEST SETUPS Menu below:

```
                        BACKUP TEST SETUPS

F1 = COPY ONE SETUP AT A TIME          F2 = DISPLAY SETUP IDS
                                            CHRONOLOGICALLY

F3 = COPY ALL SETUPS                   F4 = DISPLAY SETUP IDS
                                            ALPHABETICALLY

F5 = COPY ALL SETUPS SINCE ____        F6 = PRINT SETUP IDS
                                            CHRONOLOGICALLY

F7 =                                   F8 = PRINT SETUP IDS
                                            ALPHABETICALLY

F9 =                                   F10 = EXIT TO PREVIOUS MENU
```

SELECT A FUNCTION KEY

?-Help

Press (Shift,?) to obtain the HELP displays on p.6-7

BACKUP/RESTORE TEST SETUP MENU

Copying action is initiated by F1,F3, or F5. To help the operator decide on appropriate copying action, lists of all test setup IDs are presented by F2,F4,F6 and F8, along with the approximate number of setups that may be stored on each disk.
After selecting either F1,F3 or F5, the operator must decide whether or not to copy all test data associated with the test setups before actual copying is initiated.

F1 - COPY ONE SETUP AT A TIME - Enter the appropriate test setup ID, and respond to the additional question concerning test data.

F3 - COPY ALL SETUPS - Respond to the additional question concerning test data.

F5 - COPY ALL SETUPS SINCE _____ - Enter the appropriate date and respond to the additional question concerning test data. This is valuable for periodic backup operations.

PgDn - to continue Esc - back to menu

Press (PgDn) for the final HELP display below:

BACKUP/RESTORE TEST SETUP MENU

If a floppy disk fills up in the middle of copying a group of files (BACKUP action), the operator is asked to insert a new disk and the copying action will continue after a prompt to format or not to format. Formatting initializes a disk and destroys all data on the disk. New disks need to be formatted before they can be used.

PgUp - back up one screen Esc - back to menu

Press (Esc), then (F10), to return to the BACKUP RANDOM TESTS Menu on p.6-2. Continue on p.6-8.

Press (F5) to obtain the BACKUP TEST DATA Menu below:

```
                        BACKUP TEST DATA

F1 = COPY DATA - ONE RUN AT A TIME      F2 = DISPLAY RUN NAMES
                                             IN CHRONOLOGICAL ORDER

F3 = COPY ALL TEST DATA                 F4 = DISPLAY RUN NAMES
                                             WITH ALPHABETICAL SETUP IDS

F5 = COPY ALL TEST DATA SINCE ____      F6 = PRINT RUN NAMES
                                             IN CHRONOLOGICAL ORDER

F7 =                                    F8 = PRINT RUN NAMES
                                             WITH ALPHABETICAL SETUP IDS

F9 =                                    F10 = EXIT TO PREVIOUS MENU
```

SELECT A FUNCTION KEY

?-Help

Press (Shift,?) to obtain the HELP displays on p.6-9.

BACKUP/RESTORE TEST DATA MENU

Copying action is initiated by F1,F3, or F5. To help the operator decide on appropriate copying action, lists of all test setup IDs and the run names for saved data associated with them are presented by F2,F4,F6 and F8, along with the approximate number of data saves that may be stored on each disk.

F1 - COPY ONE RUN NAME AT A TIME - Enter the appropriate test setup ID, and the run name for the saved data. Note that the test setup ID is always necessary because run names for saved test data may be identical for two different test setups. After copying is completed, the request for another test setup ID and run name will be made.

F3 - COPY ALL TEST DATA - The copying of the entire collection of saved test data is initiated.

F5 - COPY ALL TEST DATA SINCE _____ - Enter the appropriate date (month/day/year). Test data saved since that date will be copied.

PgDn - to continue Esc - back to menu

Press (PgDn) to obtain the final HELP display below:

BACKUP/RESTORE TEST DATA MENU

If a floppy disk fills up in the middle of copying a group of files (BACKUP action), the operator is asked to insert a new disk and the copying action will continue after a prompt to format or not to format. Formatting initializes a disk and destroys all data on the disk. New disks need to be formatted before they can be used.

F2 & F6 - DISPLAY/PRINT RUN NAMES IN CHRONOLOGICAL ORDER - The run names along with the associated test setup IDs are displayed or printed in order according to the dates the data was saved.

F4 & F8 - DISPLAY/PRINT RUN NAMES WITH ALPHABETICAL SETUP IDS - The run names for saved data are displayed/printed with the associated test setup IDs and the test setup IDs are sorted in alphabetical order. Dates for the run names are also listed.

PgUp - back up one screen Esc - back to menu

Press (Esc), then (F10), to return to the BACKUP RANDOM TESTS Menu on p.6-2.

The basic excursion through the menus for the BACKUP operation is now complete. You may, however, want to EXIT to the MAINTENANCE/ CONFIG. Menu on p.6-1 and explore similar paths for the RESTORE operation to satisfy yourself of the properties noted on p.6-3.

The remainder of the chapter gives an example of an actual copying operation.

A floppy disk was inserted in the front slot of the Host Computer, and the locking handle rotated vertically. The BACKUP RANDOM TESTS Menu shown on p.6-2 was obtained. By pressing (F3), the BACKUP TEST SETUPS Menu was displayed. To aid in the BACKUP operation, the list of the saved TEST SETUPS shown below was obtained by pressing (F6).

Note the estimate for available space on both disks at the bottom of the printout. If the floppy disk had not been inserted initially, room available for "0" test setups on the floppy disk would have been reported.

```
   TEST SETUP                DATE      TIME
 1 DEMOTEST                  05/20/86 12:56:57
 2 FLATTEST                  05/14/86 10:27:14
 3 AIRPAX                    05/02/86 11:09:28
 4 FLAT                      05/01/86 13:58:44
 5 GE                        04/29/86 12:59:29
 6 BOEING                    04/24/86 11:00:53
 7 SINE                      04/21/86 07:33:22
 8 250TEST                   04/14/86 13:39:07
 9 625TEST                   04/14/86 13:22:14
10 1250TEST                  04/14/86 12:10:59
11 BENCHMAR                  04/03/86 09:56:30
12 HUGHES2                   03/17/86 13:18:47
13 CHRYSLER                  03/17/86 09:24:09
14 SPERRY                    02/19/86 04:10:57
15 M2022142                  01/22/86 15:41:23
16 M2022141                  01/22/86 15:40:51
17 RAYTHEON                  01/09/86 20:02:31
ROOM AVAILABLE FOR 3064 TEST SETUPS ON HARD DISK
ROOM AVAILABLE FOR 73 TEST SETUPS ON FLOPPY DISK
```

Next, the decision to press (F5 = COPY ALL SETUPS SINCE ---) was made to illustrate how a periodic BACKUP operation might be started. Upon pressing (F5), the date query appeared below the Menu as shown on p.6-11.

```
                    BACKUP TEST SETUPS

F1 = COPY ONE SETUP AT A TIME          F2 = DISPLAY SETUP IDS
                                            CHRONOLOGICALLY

F3 = COPY ALL SETUPS                   F4 = DISPLAY SETUP IDS
                                            ALPHABETICALLY

F5 = COPY ALL SETUPS SINCE ____        F6 = PRINT SETUP IDS
                                            CHRONOLOGICALLY

F7 =                                   F8 = PRINT SETUP IDS
                                            ALPHABETICALLY

F9 =                                   F10 = EXIT TO PREVIOUS MENU

COPY ALL SETUPS SINCE DATE: MONTH: 4 DAY: 16 YEAR: 86
ALSO COPY ALL TEST DATA ASSOCIATED WITH THE SETUP(S)? (Y,N) : N

    Esc (Back to Menu)      Enter (Accepts Entry)
```

The date 04/16/86 was entered and the query concerning copying all related test data appeared. An "N" (No) response was entered. During the copying action, the test setup being copied appears at the bottom of the display. The display shown below occurred while the "GE" test setup was being copied.

```
                    BACKUP TEST SETUPS

F1 = COPY ONE SETUP AT A TIME          F2 = DISPLAY SETUP IDS
                                            CHRONOLOGICALLY

F3 = COPY ALL SETUPS                   F4 = DISPLAY SETUP IDS
                                            ALPHABETICALLY

F5 = COPY ALL SETUPS SINCE ____        F6 = PRINT SETUP IDS
                                            CHRONOLOGICALLY

F7 =                                   F8 = PRINT SETUP IDS
                                            ALPHABETICALLY

F9 =                                   F10 = EXIT TO PREVIOUS MENU

COPY ALL SETUPS SINCE DATE: MONTH: 4 DAY: 16 YEAR: 86

COPYING SETUP GE
    Esc (Back to Menu)      Enter (Accepts Entry)
```

At the end of the BACKUP operation the display shown below appears. The number of files copied appears at the bottom of the display, and agrees with the number expected from the TEST SETUP list shown on p.6-10 and the entry date 4/16/86.

```
                        BACKUP TEST SETUPS

F1 = COPY ONE SETUP AT A TIME              F2 = DISPLAY SETUP IDS
                                                 CHRONOLOGICALLY

F3 = COPY ALL SETUPS                       F4 = DISPLAY SETUP IDS
                                                 ALPHABETICALLY

F5 = COPY ALL SETUPS SINCE ____            F6 = PRINT SETUP IDS
                                                 CHRONOLOGICALLY

F7 =                                       F8 = PRINT SETUP IDS
                                                 ALPHABETICALLY

F9 =                                       F10 = EXIT TO PREVIOUS MENU

  SELECT A FUNCTION KEY

COPY COMPLETE - 7 FILES BACKED UP
?-Help
```

After the "COPY COMPLETE" message is displayed and the red LED near the floppy insert slot is OUT, the floppy disk may be removed from the Host. When the red LED is ON, the floppy disk should not be disturbed.

When the copying is initiated after the response to the TEST DATA query shown on p.6-11 is entered, the statement and query shown below often appears just below the Menu. See HELP display on p.6-7. The decision to format the disk by entering "Y" will usually cause the copying action described earlier to be completed.

```
CAN'T CREATE BACKUP FILE. FLOPPY DISK MAY NEED TO BE FORMATTED (INITIALIZED)
OR MAY BE OF WRONG TYPE. FORMATTING DESTROYS ALL DATA ON THE DISK.
FORMAT DISK? (Y,N) : Y

    Esc (Back to Menu)       Enter (Accepts Entry)
```

Some problem, however, may prevent the formatting from being carried out. In this case the message shown below appears below the Menu.

```
DISK CAN'T BE USED. INSERT A NEW ONE AND PRESS ANY KEY TO CONTINUE
```

7. CHECKOUT - CALIBRATION

7.1 Preliminary Preparation

Sections 7.3 through 7.11 constitute a simple but reasonably complete checkout procedure that can be adapted for periodic calibration purposes. Before the checkout procedures are begun, the UD345, System Host, Video Monitor and Line Printer should be connected as described in Section 2.2 . It is not necessary or desirable to connect the signal inputs of the UD345 to charge amplifiers or connect the signal outputs to the power amplifier and remainder of the VTS as outlined in Section 2.3, however.

The 400AT/S should be placed so that it is possible to remove both top and bottom covers from the UD345, thus exposing the card adjustments from the top of the chassis and the connector terminals from the bottom of the chassis. Place the UD345 on its side so that both the card adjustments and connector terminal are accessible without repositioning the UD345. Figure 7-1 shows the locations of the card adjustments.

IF IT IS NECESSARY TO REMOVE OR REINSERT A CARD FROM THE UD345 DURING THE CALIBRATION/CHECKOUT PROCEDURE, TURN OFF THE AC POWER TO THE 400AT/S (Host, Accessories and UD345) BEFORE REMOVING OR REINSERTING THE CARD.

The Sine Test Setup (CALSINE) shown in Figure 7-2 provides a basis for calibration and checkout measurements found later in this chapter.

The following instruments are necessary for various parts of the calibration procedure. Model suggestions are also included.

Oscilloscope..... (CRO).....Hewlett-Packard 1202B
4-1/2 Digit Multimeter.. (DMM).....(AC response to 5 Hz)
Universal Counter..... (UC) .....Hewlett-Packard 5315A
Ratio Transformer..... (RT) .....Ailtech RT-20R
Sinusoidal Oscillator... (OSC).....Krohn-Hite 4100R

7.2 LOCAL Mode

The initial calibration procedures are performed with open loop operation using the UD345 in the LOCAL Mode. Proceed to run the CALSINE Test Setup shown in Figure 7-2 and switch the UD345 from the KEYBOARD to the LOCAL Mode when the prompt "Use function keys to continue" appears below the test graph. Make sure that OUTPUT is in the RESET position, when switching from KEYBOARD to LOCAL.

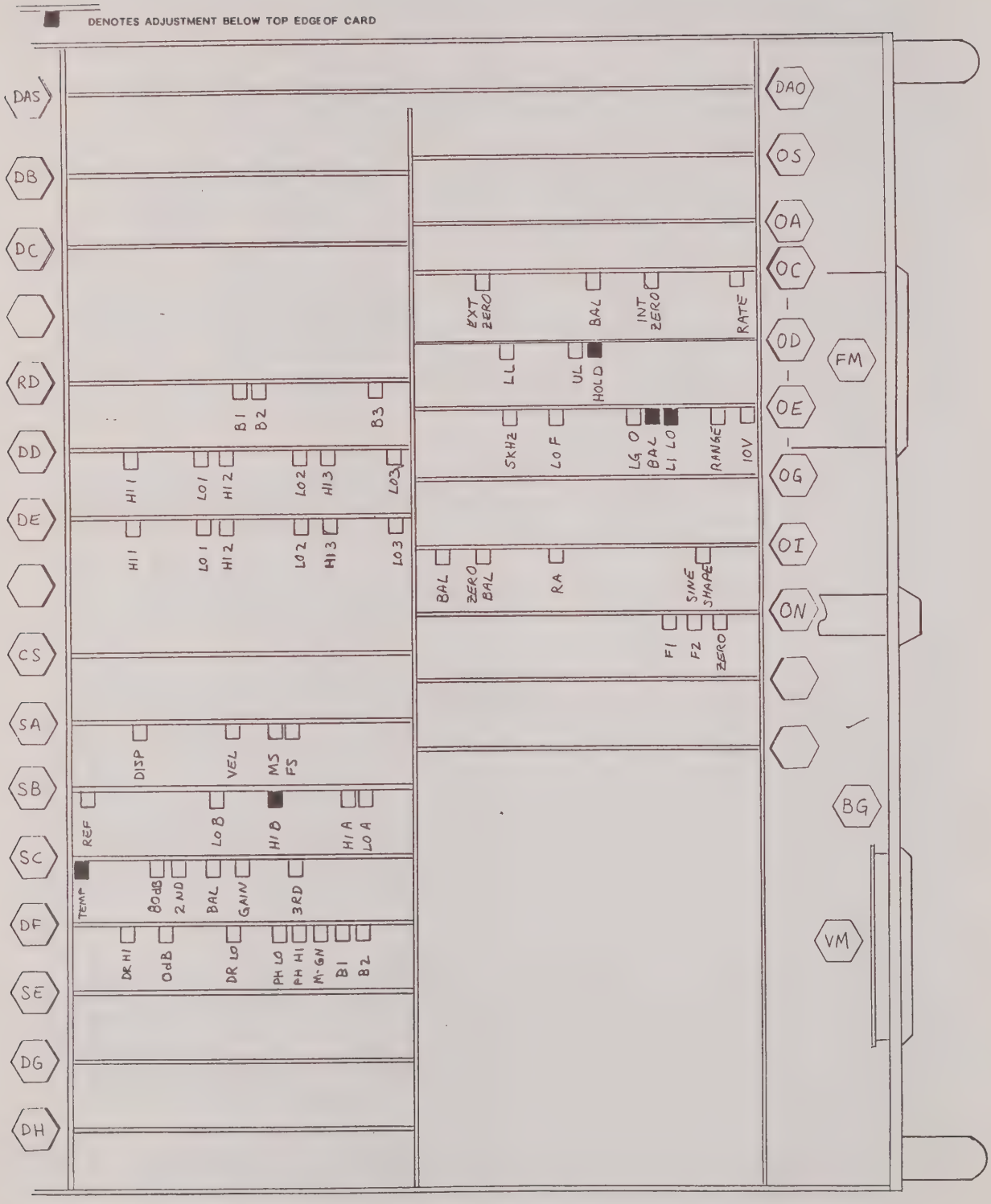


Fig. 7-1

TOP VIEW OF UD345 SHOWING CARD ADJUSTMENT LOCATIONS

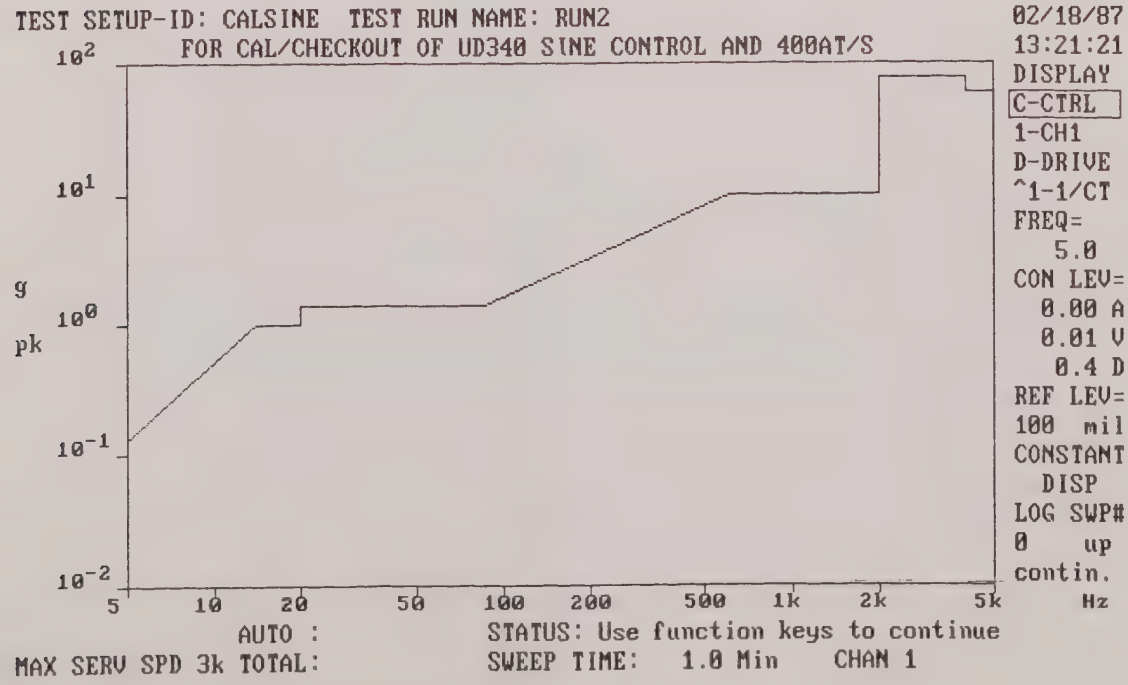
Fig. 7-2

SINE TEST SETUP

```
TEST SETUP ID : CALSINE                LAST CHANGED: 02/18/87   13:09:16

TEST DESCRIPTION : FOR CAL/CHECKOUT OF UD340 SINE CONTROL AND 400AT/S


TEST TYPE : ..................)1
     (1=LOG SWEEP,2=LINEAR SWEEP,3=DISCRETE FREQUENCIES)

NUMBER OF SWEEPS : ............)0
     (0=CONTINUOUS,1 to 9999)

MAXIMUM SERVO SPEED : .........)4
     (1=100dB/sec, 2=300dB/sec, 3=1k dB/sec, 4=3k dB/sec)

CONTROL CHANNEL INPUT SEQUENCE.)1, , , , , , ,
     (N=CHN FOR N=1-8)

LOWER FREQUENCY LIMIT (Hz) : ..)5

UPPER FREQUENCY LIMIT (Hz) : ..)5000

SWEEP TIME (Min) : ............)1

SWEEP RATE (Oct/min) : ........)9.97

STARTING SWEEP DIRECTION : ....)1
     (1=UP,2=DOWN)

STARTING FREQUENCY (Hz) : .....)5
```

SETUP ID : CALSINE PROGRAM TABLE

SEGMENT NO.	FREQUENCY (Hz)	FUNCTION (D,A,V)	LEVEL (mil pk-pk)	LEVEL (g-pk)	LEVEL (in/s-pk)	ALARM (+%)	ALARM (-%)	ABORT (+%)	ABORT (-%)
1	5	D	100	0.13	1.57	50	40	60	50
2	13.98	A	100	1	4.39	50	40	60	50
3	20	A	68.91	1.41	4.33	32	24	40	30
4	86.64	V	3.67	1.41	1	32	24	40	30
5	614.5	A	0.52	10	1	32	24	40	30
6	2000	A	0.39	80	2.46	20	24	24	30
7	4000	A	0.07	60	0.92	32	24	40	30
8	5000		0.05	60	0.74	32	24	40	30



7.3 Sweep Oscillator

7.3.1 Monitor OSC OUT with the CRO and UC.
Monitor LIN FREQ with the DMM (DC Voltage).
Also observe the frequency readings displayed by the UD345 (FM) and the Video Monitor.

7.3.2 Use the COARSE and FINE (FREQ) front panel controls of the UD345 to establish the DC voltages required at the monitoring points. Make necessary adjustments in Table 7.1 so the FREQUENCY agrees with the DC voltage settings. All adjustments are on the OE card. Repeat the measurements in Table 7.1 to check all values.

DC Voltage	Monitor	Adjust (OE Card)	Frequency (Hz) UC, Video Display, FM
10.000 ± .001V	LIN FREQ	5 kHz	5000 ± 4
10 ± 1 mV	BNC	LOW F	5.0 ± .1
10.000 ± .001V	OE-6	BAL.	5000 ± 4
5.005 ± .001V		RANGE	158.1 ± .2
(5.002 ± .001V)			(100.0 ± .2)
10 ± 1 mV		LOG ZERO	5.0 ± .1
(4 ± 1 mV)			(2.0 ± .1)

Table 7.1
Frequency Calibration (Values for 2 Hz Option)

7.3.3 Monitor OSC OUT with the DMM (AC voltage).
At 500 Hz the voltage should be 1.00 ± 2%.
Adjust OI-GAIN if necessary.
At 5 Hz and 5000 Hz, the voltage should be slightly lower.

7.3.4 Observe the waveform as the frequency is changed manually. If there is any observable distortion, or if there is any other reason to suspect drive voltage distortion, consult Sections 7.12 and 7.14.

7.4 Deleted

7.5 Drive Voltage

7.5.1 Monitor SINE DRIVE OUT with CRO and DMM (AC voltage). Turn OUTPUT to MAX and adjust frequency to 500 Hz. The DMM reading should be 8 to 9.2 V rms. If out of tolerance, adjust SC-GAIN.

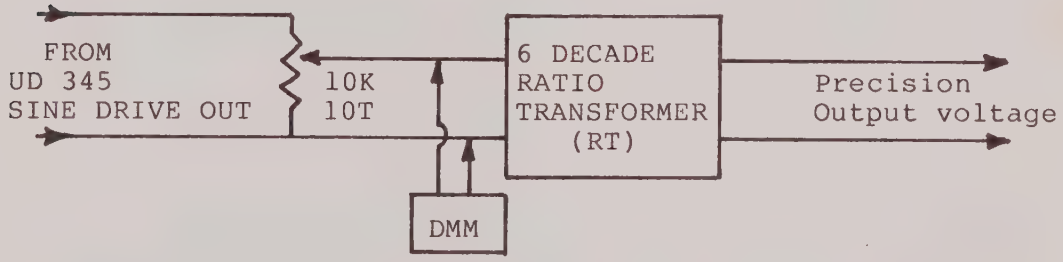
7.5.2 Enter (D) on Keyboard to observe the drive voltage on the Video Monitor. The displayed value should agree with the DMM value ±1%. Adjust DF-DRIVE HI if necessary.

7.5.3 The bar graph DRIVE VOLTAGE (dB) should read 0 dB and start to read lower values as OUTPUT is turned CCW slowly. If necessary, adjust DF-0dB so that bar display just indicates 0dB when OUTPUT is at MAX position.

7.5.4 Turn OUTPUT CCW until DMM measures 10-15 mV rms. The Drive Voltage reading on Video Monitor should agree. Adjust DF-DRIVE LO if necessary. Repeat 7.5.2 and 7.5.4. DRIVE VOLTAGE (dB) should indicate approximately -60 dB.

7.6 Charge Amplifier

7.6.1 For calibration of the charge amplifier, as well as the acceleration velocity and displacement readings, it is convenient to set up the circuit in Figure 7.3 to provide precision calibration voltages.



1.0000±.0005 V rms

Fig. 7-3 Precision AC Voltage Source

With 1.0000 V rms set at the input to the RT, the setting of the RT determines the precision voltage required. The 10 kilohm-10 turn potentiometer is used as a vernier to obtain 1.000 V rms easily from the signal source. Only the upper 5 or 10 percent of the potentiometer is used to minimize the output impedance of the signal source.

7.6.2 Apply the precision voltages in Table 7.4 below at 500 Hz in series with a 1000 pF ± 1/2% capacitor to CHG. IN. The oscillator voltage may be obtained from the SINE DRIVE OUT connector of the UD345.

A shielding box should surround the capacitor. In the LOCAL Mode adjust OUTPUT to give slightly more than 1.0 V rms to the setup in Figure 7-3. Monitor the voltage at 10 mV/g OUT with a DMM (AC Voltage) and CRO.

7.6.3 Table 7.4 gives the measured voltage at 10 mV/g OUT for several conditions. Approximate adjiustments on the SA card are shown and should be repeated after adjustments.

SENS pc/g	RANGE	INPUT TO 1000 pF Cap.	10 mV/g OUT	ADJUST
10	1-10	1.000 V	1.000+0.1%	SA-FS
1	1-10	.100 V	1.000±0.5%	SA-MS
10 1(T)	10-100	1.000 V	1.000±1.0%	Change 9000pF

Table 7.4 Charge Amplifier Calibration

7.7 Acceleration Calibration - Vibration Meter and Video Monitor

7.7.1 With the UD345 in the LOCAL Mode, type (C) for the Video Monitor to display the Control Acceleration. Put the shorting cap on the INPUT-1 connector. The VIBRATION METER (VM) should read 000.0 ±0.1g. If necessary adjust DF-B1 and DF-B2 sequentially so that the voltage at DF-TP1 is 0±20 mV DC and the VM reads 000.0g.

7.7.2 Table 7.5 shows the voltages applied to INPUT-1 and the measurements and adjustments necessary to calibrate the Vibration Meter and the acceleration display on the Video Monitor. The voltage source can be obtained from the SINE DRIVE OUT and applied through the arrangement in Fig. 7-3. Terminal DD-6 is monitored with the DMM (DC voltage). The adjustments HI3 and LO3 are done and repeated sequentially if necessary to establish the correct readings on the Video Monitor and to determine the corresponding DC voltages at terminal DD-6 (Readings A and B).

INPUT-1 (mV rms)	FREQ Hz	VIBRATION METER (g-pk)	ADJUST	VIDEO MONITOR	DD-6 to DD-11 (DCV)	ADJUST
707.1	50	100.0±.2	DF-METER GAIN	100.00±.2	A(~ 2V)	DD-HI3
70.71	50	10.0±.1	See 7.7.1	10.00±.05	B(~.2V)	DD-LO3
63.64	50	9.0±.1	See 7.7.1	9.00±.01	0.9xA	DD-HI2
7.071	50	1.0±.1	See 7.7.1	1.00±.01	B	DD-LO2
6.364	20	0.9±.1	See 7.7.1	.90±.01	0.9xA *	DD-HI1
.707	20	0.1±.1	See 7.7.1	.10±.01	B *	DD-LO1

Table 7.5 Calibration of DD amd DE Cards
Control Channel Display
* - Readings for DE Card are 10% of those shown

The adjustments for the pairs HI2, LO2 and HI1, LO1, are each done and repeated sequentially until the readings A and B are obtained ±.1%. The Video Monitor display should agree with the values in the table after this is accomplished.

7.7.3 The Video Monitor display for the Monitor Channel is controlled by the DE card. Type (1) to obtain the display for the Monitor Channel. Adjust HI3, LO3, HI1, LO2, HI1 and LO1 for the DE card in the same fashion as those controls were adjusted on the DD card in 7.7.2. The DC voltage is monitored at terminal DE-6. See note above for 20 Hz readings.

7.8 Velocity and Displacement Calibration

7.8.1 A sinusoidal voltage source is applied to INPUT-1 as in Fig. 7-3. The frequency is monitored at OSC OUT by the UC. The UD345 is again in the LOCAL mode. Press DISP to read displacement on the UD345 vibration meter, and press VEL to read velocity.

7.8.2 Table 7.6 gives voltage applied at INPUT 1, input frequencies, corresponding readings on the Vibration Meter, and applicable adjustments. Readings and tolerances for the display are also given. Type (C) if necessary to display the Control input parameters. It is necessary to set input frequency accurately (±0.1%) to preserve measurement accuracy for velocity and displacement.

Excessive errors in velocity and/or displacement measurement at 5 Hz may be due to improper operation of the tracking high-pass filter on card SB (See Section 7.14), or improper values of the resistors marked ** on card SA.

INPUT mv rms	FREQ (Hz)	VIDEO MON.	TOL.	ADJ.	UD345 VM	TOL.
460.6	40.0	100.0 in/s-pk	±1%	SA-VEL	100.0	±1%
578.8	40.0	1000. mil p-p	±1%	SA-DISP	1000.	±1%
57.57	5.00	100.0 rms pk	±2%	See text	100.0	±2%
9.043	5.00	1000. mil p-p	±3%	See text	1000.	±3%

Table 7.6 Velocity and Displacement Calibration

The values of velocity and displacement as displayed on the Video Monitor should track the values on the Vibration Meter with reasonable accuracy (±1%). If the values do not compare favorably, check that the frequency displayed on the Video Monitor agrees closely with that measured by the UC (See Section 7.3).

7.9 Reference Level - Closed Loop Control

7.9.1 Provide closed-loop operation by applying the SINE DRIVE OUT to the input of the 10 kohm 10 turn potentiometer shown in Figure 7-3, and apply the voltage at the arm of the potentiometer to INPUT-1. Set the potentiometer at 1 turn CW (gain = 0.1). Do not include the RT in the setup.

7.9.2 Run the CALSINE test. The setup is found in Figure 7-2. Press F9 (Auto Hold) at various points throughout the program and check the value of the control variable on the vibration meter and the Video Monitor display. Suggestions for the CALSINE test include the points in Table 7.7 below.

APPROX FREQ (Hz)	5	12	15	100	500	1000	3000	4500
IDEAL CONTROL LEVEL	100 mil p-p	100 mil p-p	1.00 g-pk	1.00 in/s pk	1.00 in/s pk	10.0 g-pk	80.0 g-pk	60.0 g-pk
TOLERANCE	+3%	+2%	±1%	±2%	±2%	±1%	±1%	±1%

Table 7.7 Ideal Control Levels (From Fig. 7-2)

7.9.3 Should any tolerances be exceeded, repeat the 1000 Hz point in Table 7.7 and adjust SB-REF for a reading of 10.00 g pk ±0.1% and repeat all readings. Any readings out-of-tolerance following the adjustment are probably due to variatons or errors from earlier calibration procedures (Sections 7.4, 7.7, 7.8).

SINE TEST SETUP

SETUP ID : CALSWEEP

current date : 10/26/89
: 11:38:33
last updated : 10/26/89
: 11:37:54

TEST DESCRIPTION : TO ASSIST IN CALIBRATING THE SWEEP TIME

TEST TYPE : .....>2
<1=LOG SWEEP, 2=LINEAR SWEEP, 3=DISCRETE FREQUENCIES, 4=RESONANT DWELL>

MAXIMUM SERVO SPEED : .....>3
<1= 10dB/sec, 2=100dB/sec, 3=1k dB/sec, 4=3k dB/sec>

INPUT SENSITIVITY : .....>1
<1=10mV/g, 2=100mV/g, 3=1000mV/g>

CONTROL CHANNEL INPUT SEQUENCE.>1, , , , , , ,
<N=CHN FOR N=1-8>

ANALYSIS CHANNEL SAMPLING SEQ..> , , , , , , ,
<N=CHN FOR N=1-8, or 0>

LOWER FREQUENCY LIMIT (Hz) : ..>5

UPPER FREQUENCY LIMIT (Hz) : ..>60

TEST LIMIT TYPE : .....>1
<1=NUMBER OF SWEEPS, 2=TOTAL TIME>

NUMBER OF SWEEPS : .....>1
<0=CONTINUOUS, 1 to 9999>

SWEEP TIME (Min) : .....>1

SWEEP RATE (Hz/min) : .....>55

STARTING SWEEP DIRECTION : ....>1
<1=UP, 2=DOWN>

STARTING FREQUENCY (Hz) : .....>5

MANUAL START LEVEL<-20 to -6 dB>-20

RESONANT DWELL AT END OF SWEEPS>N
<Y=YES, N=NO>

Fig.7-4
CALSWEEP
Test Setup

SETUP ID : CALSWEEP PROGRAM TABLE

SEGMENT NO.	FREQUENCY (Hz)	FUNCTION (D,A,V,S)	LEVEL (mil pk-pk)	LEVEL (g-pk)	LEVEL (in/s-pk)	ALARM (+%)	ALARM (-%)	ABORT (+%)	ABORT (-%)
1	5	A	782	1	12.28	32	24	40	30
2	60		5.4	1	1.02	32	24	40	30

7.10 Sweep Time

7.10.1 Prepare to run the test setup CALSWEEP found in Fig. 7-4. Make sure that the SWEEP TIME is 1 minute. Provide closed loop operation with a 10 Kohm, 10 turn potentiometer as before. Whenever DC voltages are measured in this section, it is extremely important that the reference probe be connected to the REF BUS between cards OC and OD.

7.10.2 Sweep HOLD - Monitor the voltage at OD-15 with the DMM. Begin CALSWEEP with (F3) and allow the frequency to increase near 50 Hz. Press (F9) to provide the HOLD action near 50 Hz. The monitored voltage should be near 100.00 mV (2 mV/Hz). Adjust OD-HOLD so there is minimum drift in the last digit of the monitored voltage over a period of about one minute.

7.10.3 Balance Adjustments -
Prepare to monitor DC voltages at OC-16, OC-9 and OC-8, as well as other points on the OC card with the DMM. Use the 200 mV range with a resolution of 0.01 mV. Keep the reference of the meter on OC-11 or OC-12 to assure accurate readings.

Revise the SWEEP TIME on the CALSWEEP Test Setup to 99 min. Begin CALSWEEP with (F5-Manual) and use the arrow keys (not (F7)) to obtain 60 Hz.

Measure DCV at (OC-16) = (VOFF).
This is the approximate offset of the MDAC (U28 and U29) on DAO.

Measure DC voltage at (OC-8) and (OC-9).
Compute: VDIF = (OC-8)-(OC-9)

Compute: Desired voltage at (Z1-10) = (VOFF)-(VDIF)
Monitor Z1 pin 10 on OC card and adjust INT. ZERO to provide the above desired voltage at Z1-10.

Monitor TP1 on OC card and set the measured DCV at -(VDIF)/99 with the EXT. ZERO pot (approx. -.02 mV)

Monitor TP2 on OC card and set the measured DCV to (VDIF)/99 with the BAL pot. (approx +.02 mV)

7.10.4 Revise SWEEP TIME for CALSWEEP Test to 1 min.
Obtain the test graph on the Display but do not press (F3) or (F5) to begin the test.
Measure DCV at TP1 = -(VDIF)
and DCV at TP2 = +(VDIF) = 110 mV ± 5 mV

7.10.5 Edit the CALSWEEP Test Setup to provide the following changes:

```
TEST TYPE: .....> 1 (LOG SWEEP)
UPPER FREQUENCY LIMIT (Hz).....>5000
SWEEP TIME (Min).....>2
```

Run the edited CALSWEEP test once with (F3), leave the test (F10), and return to run the test (F7). Obtain the test graph on the video display, but do not press (F3) or (F5) to continue the test.

Measure the DCV at TP1 (TP1 NEW), and leave test (F10).

Edit the Test Setup to provide a SWEEP TIME or 3 min., END the setup. Then return and reedit the test for a SWEEP TIME of 2 min. END the setup and return to run CALSWEEP, but do not press (F3) or (F5) when the graph appears. Monitor DCV at TP1 and adjust RATE pot. to provide a voltage equal to (TP1 NEW) measured above.

This procedure in 7.10.5 allows the Host to compute the proper value of (TP1 NEW) to provide a 2 min. sweep time after one try. The calculated value provided by the Host is destroyed by the reediting process, and the raw value of the DC voltage at TP1 is then readjusted to the proper value of (TP1 NEW) to provide a 2 minute sweep without significant correction by the Host.

7.10.6 If it is desired, to check the accuracy of other sweep times, edit the entries of Fig. 7-4 for TEST TYPE, FREQUENCY LIMITS, SWEEP TIME, STARTING SWEEP DIRECTION and STARTING FREQUENCY accordingly. Then run the single sweep test several times and record the sweep time displayed at the end of each test.

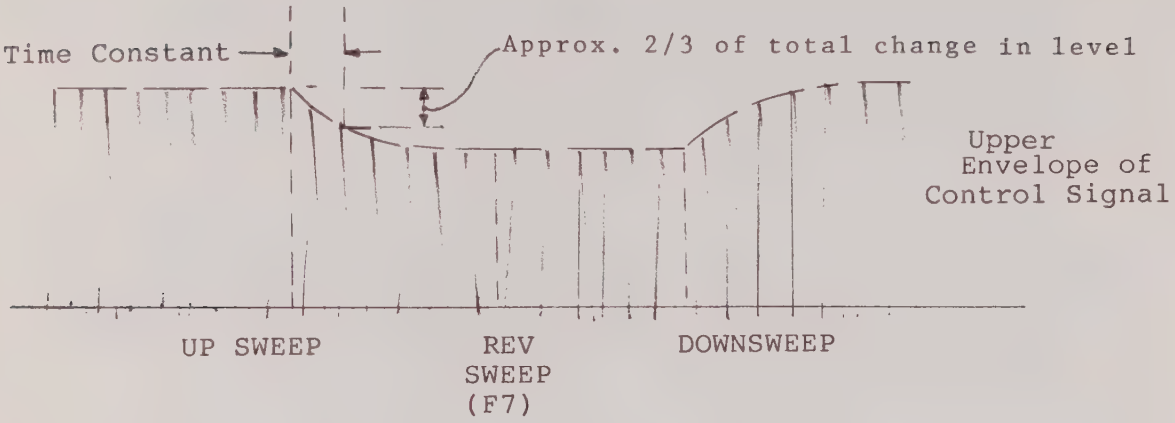
The first sweep time after editing depends only upon the calibration results above, but each successive sweep time is a result that should be closer to the desired sweep time as a result of the Host automatically adjusting the MDAC gain to compensate for sweep time errors. This MDAC gain is stored in the setup for successive tests, as long as the critical TEST SETUP entries are not edited. Separate MDAC gains are stored for sweeps up and for sweeps down.

7.11 Servo Speed

7.11.1 Edit the entries for the CALSINE Test Setup to restore the test as given in Fig. 7-2. Make sure that continuous sweeps are provided. Prepare to run the test in closed-loop fashion as described in 7.9.1. Monitor INPUT-1 with the CRO, and prepare to view the envelope of the control voltage.

7.11.2 Run the CALSINE test and allow the frequency to sweep to the vicinity of 4 kHz. Press (F7) repeatedly to reverse the sweep and cause the transition at 4 kHz from 60g to 80g and vice versa to occur. The observed control voltage envelope should look like Fig. 7-5.

Fig.7-5 Time Constant Measurement



7.11.3 The time constant for the signal envelope changes at A and B in Fig. 7-5 should be 4±2 msec. The CRO time base should be about 5 ms/cm. Control signal envelope time constants (for small changes) are related to servo speed (dB/s) by the following relationship:

$$\text{Time constant (ms)} = 10^4 / \text{Servo speed(dB/s)}$$

7.11.4 Allow the frequency to sweep to the vicinity of 20 Hz and then press (F7) repeatedly to reverse the sweep and cause the transition from 1.41 g to 1 g and vice versa to occur. Adjust the CRO time base to display the signal envelope (time base about .5s/cm).

7.11.5 The time constant for the signal envelope changes should be 500 ±200 ms. Consult Section 7.13 if either measurement is out of tolerance.

7.11.6 AGC Balance - Allow the frequency to sweep to the vicinity of 1 kHz and observe the signal envelope as (F7) is used to trigger the transition from 80g to 10g and vice versa. Refer to Fig. 7-6 for the transition from 80g to 10g.

Fig. 7-6 AGC Balance

The transition to 10g should be centered on the CRO baseline as shown in the CORRECT version of Fig. 7-6
Adjustment of SC-BAL should center the 10g trace of either of the INCORRECT versions of Fig. 7-6.

THE FOLLOWING SECTIONS DESCRIBE PROCEDURES THAT ARE NOT NORMALLY PART OF ROUTINE CHECKOUT AND CALIBRATION PROCEDURES. DO NOT ATTEMPT THESE IF THERE IS NO INDICATION OF UNSATISFACTORY PERFORMANCE. Those potentiometer adjustments not included in Sections 7.1 through 7.11 are discussed in the following sections.

7.12 Harmonic Distortion

7.12.1 Distortion Analyzer - In addition to the instruments suggested earlier, an audio distortion analyzer, or a FFT spectrum analyzer is also required. For audio distortion analyzers, the Krohn-Hite Models 6880 and 6900, and the Hewlett Packard Model 8903 are suggested.

7.12.2 Operate the UD345 in the LOCAL Mode.
Monitor OSC OUT with the CRO and Distortion Analyzer.

7.12.3 At 300 Hz adjust OI-BAL to provide minimum 2nd harmonic distortion. Then adjust OI-SINE SHAPE to provide minimum 3rd harmonic distortion. Adjustment of OI-ZERO BAL insures that the zero level stairsteps for both positive and negative halves of the sinusoid are the same. It affects 2nd harmonic distortion slightly, but not nearly so much as OI-BAL. Typically the minimum distortion at 300 Hz is 0.05% and the maximum allowable value is 0.3%.

7.12.4 At 5 kHz the maximum harmonic distortion is 0.5% and the typical measured value is 0.15 - 0.20%. The capacitor marked ** on the OI card minimizes delay unbalance and 2nd harmonic distortion at 5 kHz. It is factory-selected and does not usually need to be changed.

7.12.5 Monitor SINE DRIVE OUT with the CRO and Distortion Analyzer. Provide closed-loop operation as in Section 7.9.1. Run the CALSINE test and allow the frequency to sweep to about 650 Hz and press (F9), causing the frequency to remain constant.

7.12.6 Measure the harmonic distortion. Typically the value is 0.1% with a maximum of 0.3%. If necessary, adjust SC-2nd and SC-3rd to minimize 2nd and 3rd harmonic distortion respectively. The voltage at SINE DRIVE OUT should be about 0.7V rms. These adjustments affect maximum output and AGC balance so it may be necessary to repeat Section 7.5.1 (SC-BAL).

7.12.7 Press F1 (Abort). Adjust SC-80dB until signal component disappears at SINE DRIVE OUT and wideband noise remains.

7.13 Servo Speed Adjustment

7.13.1 Remove AC power from the UD345.
Remove the SB card (AGC Control) and place it on an extender.
Remove Z8(DG 200) from the SB card.
Remove the SC card (AGC Amp) from the UD345.
Reapply AC power to the UD345, and put the UD345 in the LOCAL mode from the CALTEST setup.

7.13.2 Monitor the resistance between SB-TP2 and SB-TP3 with the DMM. Make sure both input terminals to the DMM are floating (not connected to signal reference).

7.13.3 Set the frequency to 5 kHz and adjust SB-HI-B so that measured resistance is 3.3k ±10%. Set the frequency to 5 Hz and adjust SB-LO-B so that measured resistance is 1.0M ±20%. Repeat these two steps. The relationship between measured resistance and servo speed is

$$\text{SERVO SPEED (dB/s)} = 10^7/\text{Resistance (ohms)}$$

7.13.4 Remove AC power from UD345, replace Z8, return SC card to the UD345, and return SB card directly to the internal connector. Reapply AC power to the UD345.

7.14 Tracking High-Pass Filter

7.14.1 Remove AC power from the UD345.
Remove the SA card (Chg. Converter).
Apply 1.0V rms from an external oscillator to terminal SB-6.

Monitor the output from SB-7 with a CRO and DMM (AC voltage).
Reapply AC power and put the UD345 in the LOCAL mode.

7.14.2 Table 7.8 gives measurements, and adjustments for various values of the external oscillator frequency and the frequency of the UD345.

EXT. OSC. FREQ. (Hz)	SB-6 INPUT V rms	UD345 FREQ. (Hz)	SB-7 OUTPUT V rms	ADJUST
500	1.0	1500	.7-.8	SB-HI-A
5	1.0	15	.7-.8	SB-LO-A

Table 7.8 Calibration of Tracking Hi-Pass Filter

Repeat the measurements and adjustments in Table 7.8.

7.14.3 For equal settings of the frequencies of the external oscillator and the UD345 at 5, 15, 150, and 500 Hz check that the output voltage at SB-7 (input at SB-6=1.0V) does not vary from a median value of 1.00 ±3% V rms by more than ±1%. If the above tolerances cannot be met, the EVR's (V1, V2 and V3) are not matched well enough. Consult factory.

7.14.4 Remove AC power from the UD345.
Replace the SA card. Reapply power to the UD345.

7.15 Tracking Low-Pass Filter

Should the OSC OUT voltage not remain constant (±6%) in amplitude over the 3 decade range in 7.3.4, or if 32nd harmonic stair-step distortion is noticed, the adjustments on the ON card (Tracking Low-Pass Filter) should be checked. If replacement of the EVR's (electrically-variable-resistors) is indicated, purchase a matched set from the factory.

7.15.1 Observe AC power precautions as before.
Remove the OI-card (Sine Generator).
Connect an external sine oscillator to terminal ON-17.
Monitor ON-TP1 with a CRO and DMM (AC voltage).
Adjust the external oscillator for 1.00 V rms.
Put the UD345 in the LOCAL mode.

7.15.2 ON-F1 (Flatness). Set the UD345 frequency at 100 Hz. Sweep the external oscillator frequency and note the response at TP1. For an external frequency of 150 Hz adjust ON-F1 for 1.0V rms at ON-TP1.

7.15.3 ON-ZERO. Set the UD345 frequency at 10 Hz and the external oscillator at 30 Hz. Adjust ON-ZERO for 0.71 V rms at TP1.

7.15.4 ON-F2 (Flatness). Monitor ON-18 with the CRO and DMM (AC voltage). Set UD345 frequency at 100 Hz. Sweep the external oscillator frequency and note decrease in response at high frequencies. For an external oscillator frequency of 125 Hz adjust ON-F2 for 1.0 V rms.

7.15.5 Remove the external oscillator, observe AC power precautions and replace OI card. Sweep UD345 frequency from 5 Hz to 5 kHz. There should be no visible 32F stair-step distortion and the voltage at OSC OUT should be constant ±5%.

7.16 LINEAR SWEEP

7.16.1 Edit the CALSINE Test Setup for the following line items to provide a linear sweep:

```
TEST TYPE.....>2
SWEEP TIME (min)....>10
```

Begin the CALSINE test and switch to LOCAL mode as in Section 7.2.

7.16.2 Vary the COARSE and FINE controls to provide nearly 10.0 mVDC at terminal OE-6. Monitor voltage at OE-21 and adjust OE-LIN LO to provide the same voltage measured at OE-6 ±0.1mV.

7.16.3 Change the COARSE and FINE controls to provide 10.000VDC at OE-6. The voltage at OE-21 should be 10.000 ± .002VDC.

7.16.4 It may be necessary to repeat Section 7.4 if OE-LIN LO is readjusted.

7.17 Vibration Meter and Drive Voltage (0dB)

The VM-GAIN and BG-GAIN controls need not be readjusted since they duplicate the functions of the DF-METER GAIN and DF-Odb adjustments respectively.

7.18 Power Supply Voltages

Table 7.9 lists all power supply voltages and other voltages on the OPS and SPS cards all measurements are relative to signal or logic reference and are useful prior to any general trouble-shooting procedure.

LOCATION	VOLTAGE (VDC)	RIPPLE
OPS-1 (11)	15.5 ±.2	max 10 mv pp
OPS-2 (11)	-15.5 ±.2	max 10 mv pp
OPS-22 (12)	5.0 ±.3	max 50 mv pp
OPS-TP1	+9.0 to +11.7 VDC	typ 0.7 v pp
OPS-TP2	-22.8 to -28.0 VDC	typ 1.2 v pp
OPS-TP3	+22.8 TO +28.5 VDC	typ 1.2 V PP
SPS-1	+15.5 ±.2	max 10 mv pp
SPS-2	-15.5 ±.2	max 10 mv pp
SPS-22	+5.0 ±.3	max 50 mv pp
SPS-TP1	+7.8 to +10.4 VDC	typ 1.1 v pp
SPS-TP2	-22.0 to -27.8 VDC	typ 1.8 v pp
SPS-TP3	+22.0 to +27.5 VDC	typ 2.0 v pp
OE-8 (11)	10.06 ± .04	2 mv pp

Table 7.9 Power Supply Voltages

7.19 Sweep Frequency Limits - DASCON 1 Card

7.19.1 IMPORTANT: Before making adjustments on the DASCON 1 Card in the Host computer, the instructions below must be followed:

At the UD System Logo Page press (Alt, F8) simultaneously.
The C> should appear immediately.
Type "UD 150" and enter. The System Logo page reappears.

This will allow you to make the adjustments described below on the DASCON 1 card accurately. Be sure to follow the instructions in 7.19.8 before attempting to do sine testing. The "UD 150" entry to the system is intended only for the calibration of the DASCON 1 Card.

7.19.2 The adjustments that control the accuracy of the LOWER and UPPER FREQUENCY LIMITS are found on the DASCON 1 interface card which is installed in the host computer. Remove the cover of the host computer to expose the DASCON 1 card (connector slot 7). Refer to Fig. 7-7.

7.19.3 Enter the SINE TEST Mode.
Edit the CALSINE test setup to provide a linear sweep from 5 to 55 Hz starting in the up direction. Initiate the test but do not attempt to start the sweep with the F3 key. Monitor terminal OE-6 and adjust the DAC-Ø ZERO for 10.000 ± .02 mVDC.

7.19.4 Edit the CALSINE test setup to provide a starting frequency of 55 Hz in the down direction. Initiate the test as before. Adjust DAC1-ZERO for 110 mV at terminal OE-6.

7.19.5 Edit the CALSINE test setup to provide a downsweep from 5000 Hz. Adjust DAC1-F.S. to give 10.001 VDC at terminal OE-6.

7.19.6 Edit the CALSINE test setup to provide an upsweep from 4900 Hz to 5000 Hz. Adjust DACØ-F.S. to give 9.800 VDC at terminal OE-6.

7.19.7 Repeat the adjustments in 7.19.3 through 7.19.6 until the measurements are satisfied.

7.19.8 To return to the normal operating system,

Return to the System Logo Page.
Press (Alt, F8) simultaneously.
In response to C>, type "UD" and enter.

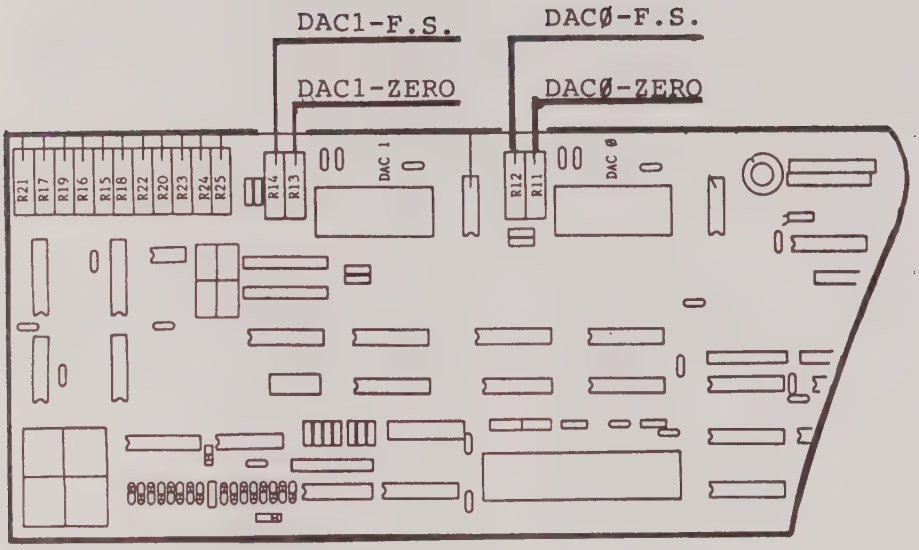


Fig. 7-7 DASCON 1 Layout

8. CIRCUIT SCHEMATICS - LAYOUTS
SPECIAL RESONANT DWELL OPTION

Fig.	Description		Dwg.No.	Rev.
8.1	UD345 - Chassis Wiring Schematic		D20281	
8.2	DAS-DAO - Interface Card -------	Schematic	D20476	B
8.3		- Layout	D20207	B
8.4	DB - 8 Channel Multiplexer -----	Schematic	C20228	
8.5		- Layout	B20230	
8.6	DC - 8 Channel Monitor ---------	Schematic	C20204	A
8.7		- Layout	B20234	
8.8	RD2 - Phase Detector-Clipper ---	Schematic	B20279	
8.9		- Layout	B20280	
8.10	DD,DE Tri AC-DC Converter -----	Schematic	C20495	A
8.11		- Layout	A20474	B
8.12	CS - Chip Select ---------------	Schematic	B20237	
8.13		- Layout	B20239	
8.14	SA - Charge Amp/Integrator -----	Schematic	C13737	D
8.15		- Layout	B13722	C
8.16	SB - AGC Control ---------------	Schematic	C13738	J
8.17		- Layout	D13714	E
8.18	SC - AGC Amplifier -------------	Schematic	C20201	B
8.19		- Layout	B13720	F
8.20	DF - Local/Keyboard/Meter ------	Schematic	C20478	A
8.21		- Layout	A20206	A
8.22	SE - Mode Control --------------	Schematic	C13740	A
8.23		- Layout	B13716	B
8.24	DG - Sine/Random Selector ------	Schematic	C20244	
8.25		- Layout	B20245	
8.26	DH - Decimal Point Select ------	Schematic	A20221	
8.27		- Layout	A20222	
8.28	OS - Oscillator Mode Control ---	Schematic	B9371	A
8.29		- Layout	B9370	A
8.30	OA - Sweep Light Control -------	Schematic	B20202	A
8.31		- Layout	B20203	A
8.32	OC - Sweep Speed Control -------	Schematic	B20210	B
8.33		- Layout	A9298	E
8.34	OD - Sweep Generator -----------	Schematic	C9296	J
8.35		- Layout	B9299	K
8.36	OE - Log Conv/Hi Freq Gen ------	Schematic	B20481	B
8.37		- Layout	B20482	B
8.38	OG - Freq Div/Counter Cont -----	Schematic	C20235	
8.39		- Layout	C20240	
8.40	OI - Sine Generator ------------	Schematic	C9284	C
8.41		- Layout	D9263	D
8.42	ON - Tracking Low-Pass ---------	Schematic	B9321	B
8.43		- Layout	A9322	D
8.44	FM - Frequency Meter -----------	Schematic	A20233	A
8.45		- Layout	A20267	
8.46	BG - Bar Display ---------------	Schematic	A19122	A
8.47		- Layout	A20271	
8.48	OPS, SPS Power Supply ----------	Schematic	B13819	B
8.49		- Layout	B13724	D
8.50	RD1 Clipper -------------------	Schematic	B20277	
8.51	" -------------------	Layout	B20278	

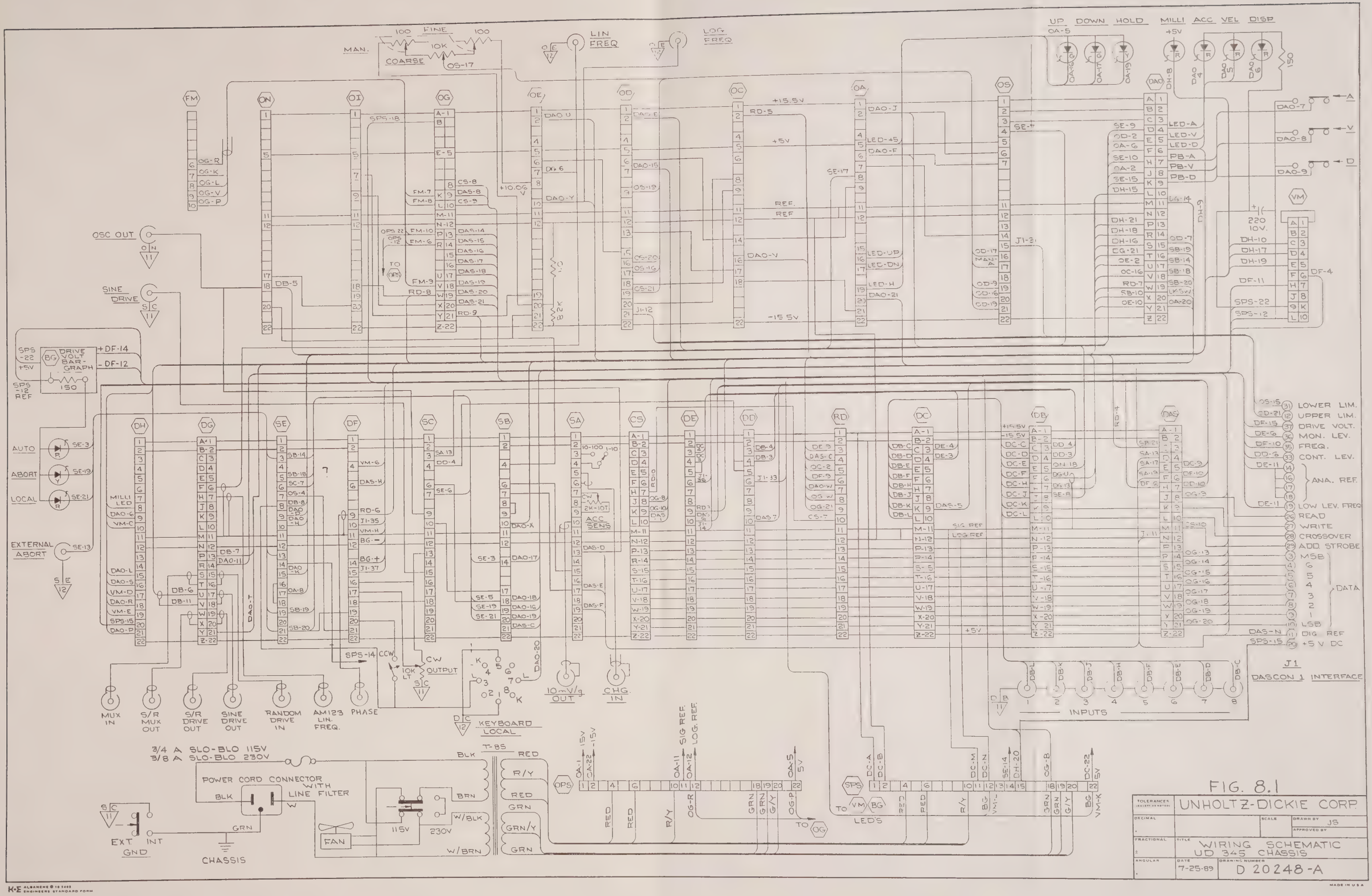


FIG. 8.1

TOLERANCES (UNLESS NOTED)	UNHOLTZ-DICKIE CORP		
DECIMAL .		SCALE	DRAWN BY JS
			APPROVED BY
FRACTIONAL ±	TITLE WIRING SCHEMATIC UD 345 CHASSIS		
ANGULAR .	DATE 7-25-89	DRAWING NUMBER D 20248-A	

K+E ALBANENE © 10 7403 ENGINEERS STANDARD FORM
MADE IN U.S.A.

WRITE (SP)

PC BUS: AS (S11), X (S10), WRITE (S9), READ (S8)

PB BUS: D0 (S21), (S20), (S19), (S18), (S17), (S16), (S15), D7 (S14)

STATUS: UP/DN (O15), STBY (O16), ON (O17), L CAL (O18), OFF (O19), LOC/KEY (O20), HOLD (O21), (O22)

DATA BUS

CONTROL BUS

D0. D6

U8 74S244 ENA ENB

U9 74S244

U10 74ALS244 ENA ENB

U11 74ALS244 ENA ENB

U12 74ALS574 C EN

U14 74ALS244 ENA ENB — CONTROL: (OX) ON, (OT) SWP, (OH) STBY, (OF) HOLD, (OE) REV, (OD) L CAL, (OB) RST UP, (OC) RST DN

U17 74ALS244 ENA ENB — PB BUFF: (SY), (SX), (SW), (SV), (SU), (ST), (SS), (SR)

U20 74ALS574 C EN — (O5) DP1, (OR) DP2, (OP) DP3, (OL) MILLI, (O14) S/R MIX, (O13) FCR OUT, (O12), (O11) SINE AB.

U27 74154 — CHIP SELECT: (S13), (S5) MON CH, (S6) FSR MON, (SL) AVE DATA, (SK) AVE START, (S7) FSR CONT, (S12)

U18 74ALS574 C EN

U19 74ALS574 C EN

U28 AD7541A — 499Ω*, 10PF, OPA121 U29, +VDDR, -VDDR, +VDDR

U30 74ALS138 — VCC

U31 DG201 — +VDDR -VDDR

(QY) LOG DC IN: 200K* (2.00K), 2.49K* (5.90K), 3.48K* (6.98K), 6.98K* (JUMPER), RD OPTION - ( )

(QX) COMPR. SPEED CONTROL

(OU) LOG/LIN

(OT) SINE/RAND

(OV) SWP. RATE OUT

(OW) SWP. RATE IN

U13 74ALS574 C EN

U22 74ALS574 EN C

U15 74ALS574 C EN

U23 74ALS574 C EN

U16 74ALS574 C EN

U24 74ALS574 C EN

U21 74ALS244 ENA ENB

U25 74ALS244 ENA ENB

U26 74ALS244 ENA ENB

U6 AD7541A — 110K*, 10PF, OPA121 U7, +VDDL, -VDDL, +VDDL

47Ω, 2 (100µF), (SC) CONTROL OUT, 47K, (SM) SIG. REF.

U32 74LS279 — PB DISP, PB VEL, PB ACC, (6) IN100, VCC, 1K, IN100, 10µF, Q1 2N4401, 10K

U1 DG201 — ACC IN (SD), VEL IN (SE), DISP IN (SF), 1µF, (3) 1M, 10M, +VDDL -VDDL

U2 OPA121 — +VDDL, 47Ω, (2) 220µF, -VDDL

U3 DG201 — 9.00K, 900., 90.0, 10.00 (ALL 0.1%), +VDDL -VDDL, 1M

U4 OPA121 — +VDDL, -VDDL, 19.1K*, 1K*

U5 OPA121 — 40.2K*, 10K*, +VDDL, -VDDL, 47Ω, 1µF, 1M

U#*	+VCC	DGND
U8, U9, U10, U11, U12, U13, U14, U15, U16, U17, U18, U19, U20, U21, U22, U23, U24, U25, U26	PIN 20	PIN 10
U27	PIN 24	PIN 12
U30, U32	PIN 16	PIN 8
U33, U34, U35, U36, U37, U38, U39	PIN 14	PIN 7

+15.5 VDC (SA) (S1) +VDDL .1µF

-15.5 VDC (SB) (S2) -VDDL .1µF

+5V DC (SZ) (S22) VCC — 47µF, .1µF, .1µF, .1µF, .1µF, .1µF, .1µF, .1µF, .1µF — ALL DIGITAL IC'S DECOUPLED

DIG. REF. (SN)

+VDDR: (QA) +15.5 VDC, .1µF

-VDDR: (QZ) -15.5 VDC, .1µF

(OM) (ON) OSC REF.

(SH) METER

D6 (O6) DISP LED

D5 (O5) VEL LED

D4 (O4) ACC LED

DAS S-

DAO O-

DIG-REF.

SIG-REF

OSC-REF.

FIG. 8-2

* 1% METAL FILM-RN55

U33-U36 74ALS00

U37-U39 74ALS04

DATE	REV	DESCRIPTION	BY
		U3 RES. - U28 REF PIN 3	TU
10/89	B	U20 OUT CORR. - RD OPT U31	TU
3/88	A	DP OUT & U7 GAIN	LEM

UNHOLTZ-DICKIE CORP

TOLERANCES: DECIMAL ± ; FRACTIONAL ± ; ANGULAR ±

SCALE — DRAWN BY JS — APPROVED BY

TITLE: UD 345 INTERFACE BOARD

DATE: 12-27-86 — DRAWING NUMBER: D20476 B

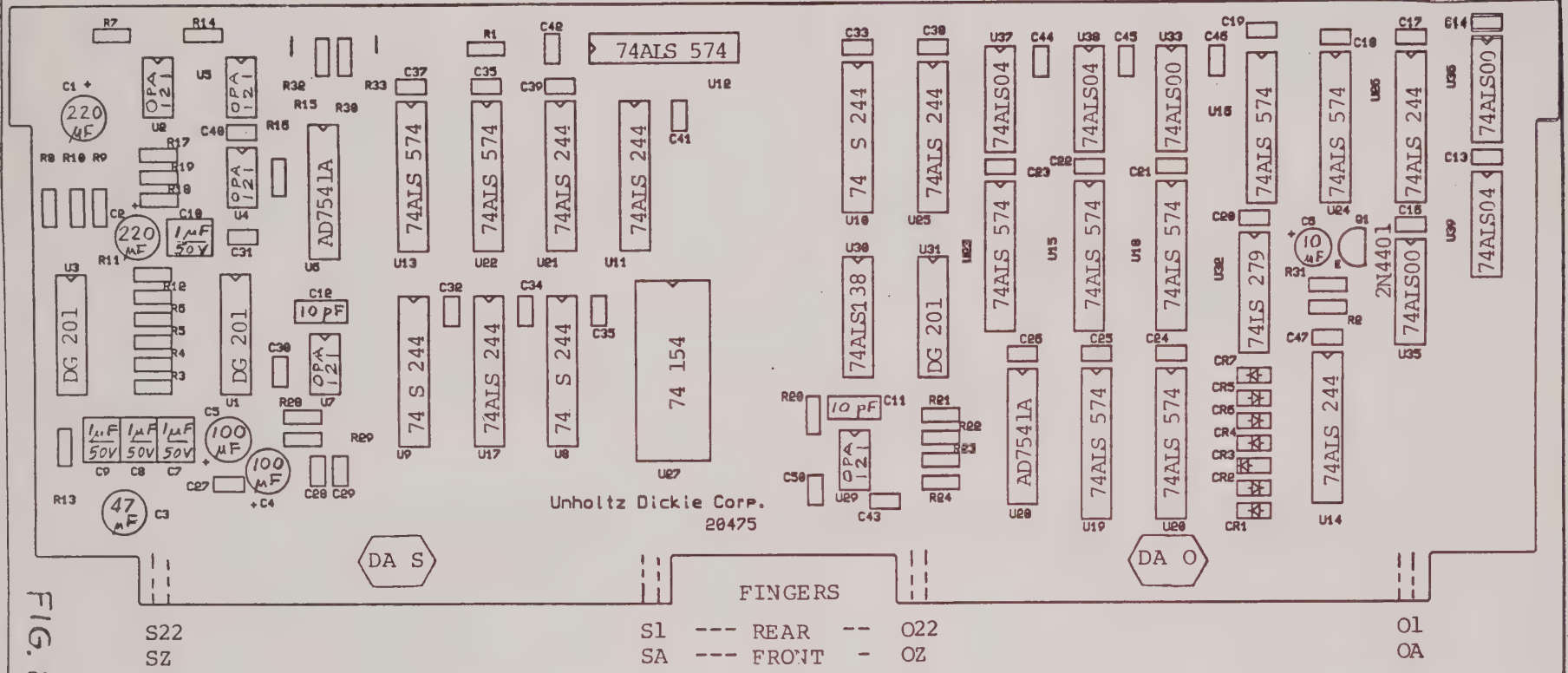


FIG. 8.3

R1	1.0 K	R13	1.0 M	R22	5.90 K *
R2	10 K	R14	1.00K *	R23	6.98 K *
R3	1.0 M	R15	19.1K *	R24	JUMPER
R4	1.0 M	R16	47	R28	47
R5	1.0 M	R17	10.0K *	R29	47 K
R6	10 M	R18	1.0 M	R30	110 K *
R7	47	R19	40.2K *	R31	1.0 K
R8	9.00 K **	R20	499 *	R32	0
R9	900 **	R21	2.00K *	R33	0
R10	90.0 **	R22	2.49K *	C13 thru C50	0.1 µF 20V
R11	10.00 **	R23	3.48K *		
R12	1.00K *	R24	6.98K *		

RD OPTION

ALL DIODES (CR1--CR7) --- 1N100

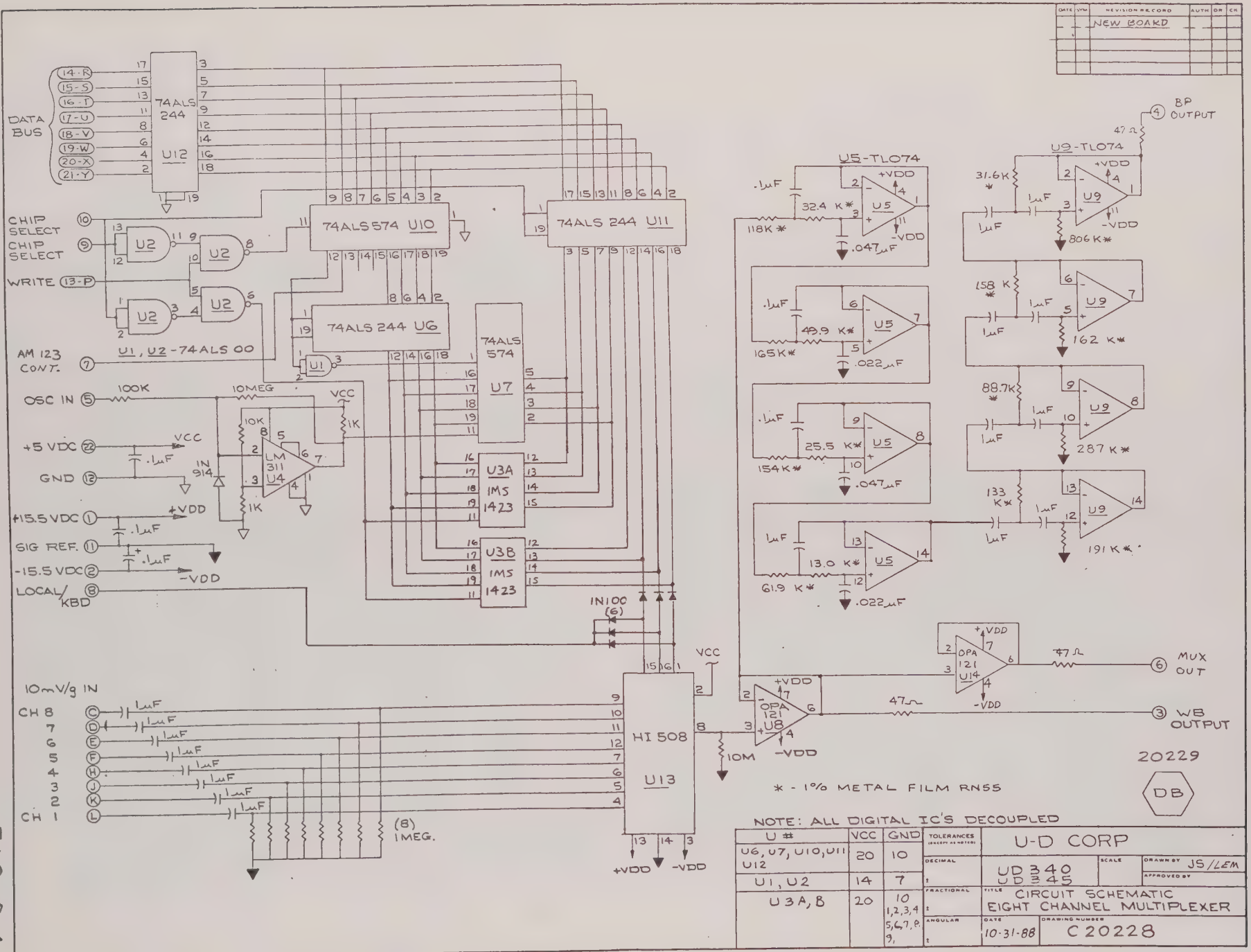
* - 1% METAL FILM RN55 RESISTORS

** - 0.1 % METAL FILM

DAS DAO

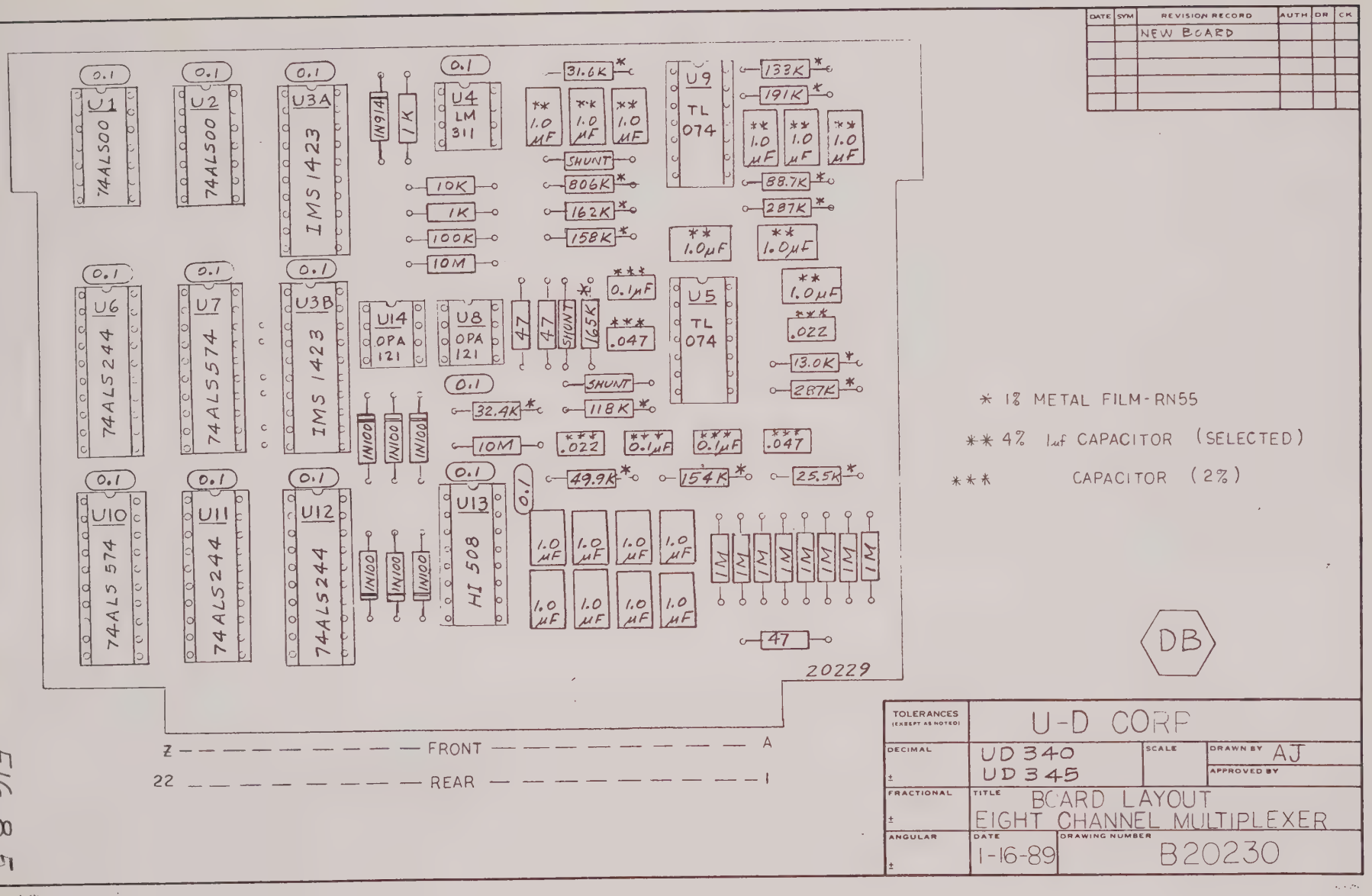
TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORPORATION		
DECIMAL	UD345	SCALE	DRAWN BY TU
			APPROVED BY
FRACTIONAL	TITLE LAYOUT- INTERFACE CARD		
ANGULAR	DATE 10/89	DRAWING NUMBER A20207B	

MADE IN U.S.A.



U #	VCC	GND
U6, U7, U10, U11 U12	20	10
U1, U2	14	7
U3A, B	20	10 1,2,3,4 5,6,7,8 9,

FIG. 8.4



* 1% METAL FILM-RN55

** 4% 1uf CAPACITOR (SELECTED)

*** CAPACITOR (2%)

DATE	SYM	REVISION RECORD	AUTH	DR	CK
		NEW BOARD			

DB

TOLERANCES (EXCEPT AS NOTED)	U-D CORP		
DECIMAL ±	UD 340 UD 345	SCALE	DRAWN BY AJ APPROVED BY
FRACTIONAL ±	TITLE BOARD LAYOUT EIGHT CHANNEL MULTIPLEXER		
ANGULAR ±	DATE 1-16-89	DRAWING NUMBER B20230	

FIG 8.5

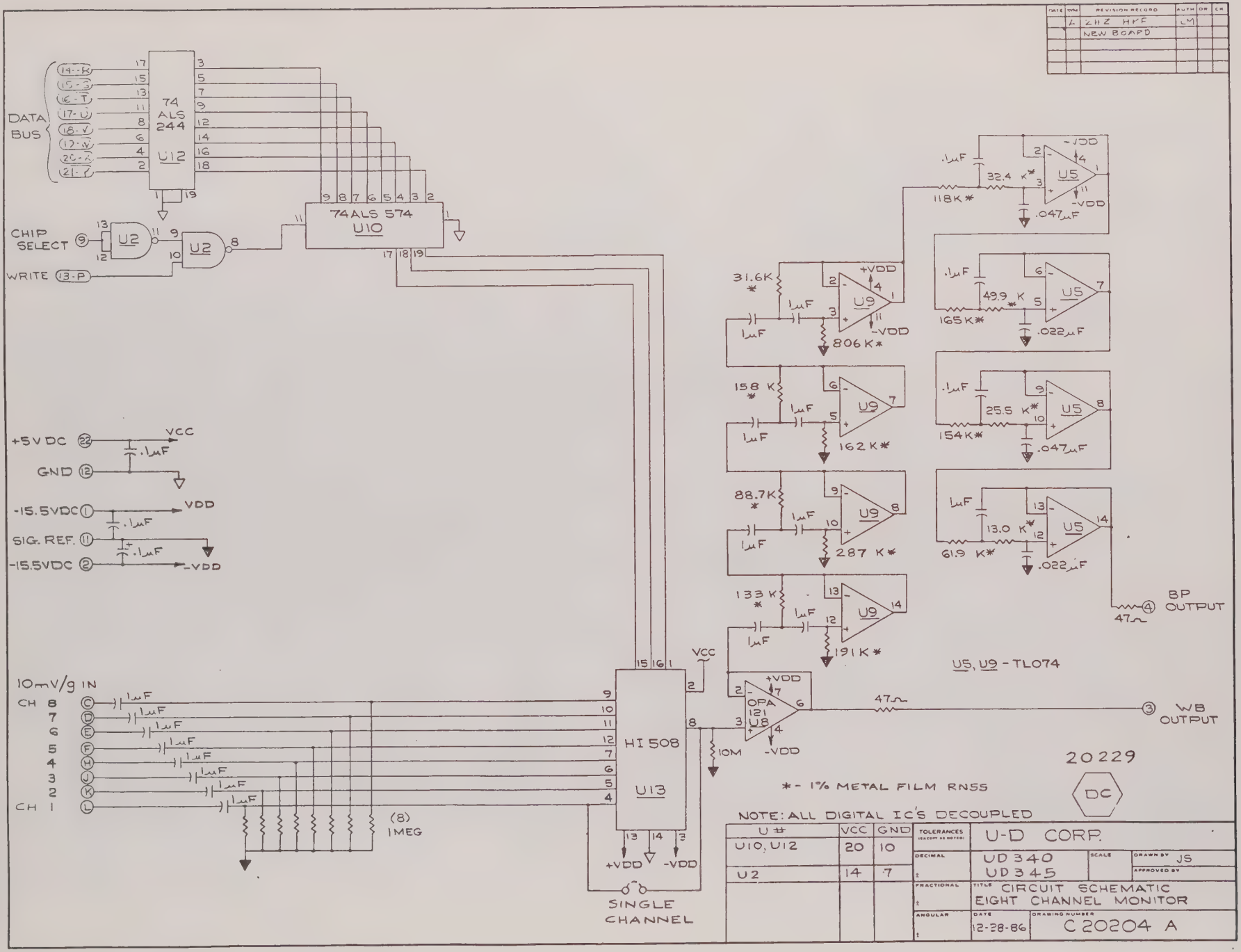
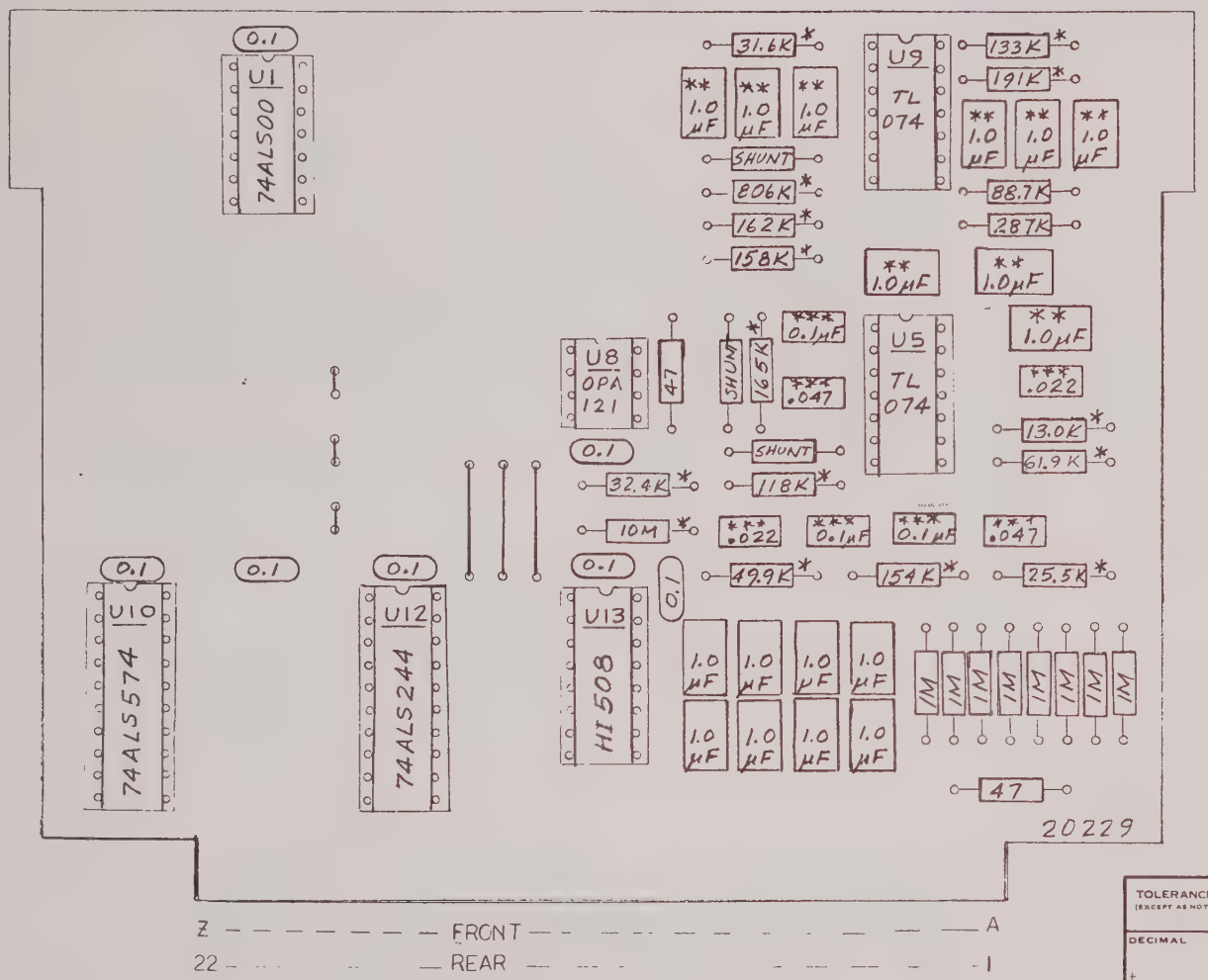

DATA BUS
74 ALS 244 U12
74ALS 574 U10
CHIP SELECT
WRITE
U2
+5V DC
GND
-15.5VDC
SIG. REF.
VCC
VDD
-VDD
10mV/g IN
CH 8
CH 1
1MEG
HI 508 U13
SINGLE CHANNEL
+VDD
-VDD
U9
U5
OPA 121 U8
10M
47Ω
BP OUTPUT
WB OUTPUT
U5, U9 - TL074
*- 1% METAL FILM RN55
NOTE: ALL DIGITAL IC'S DECOUPLED
20229
DC
U-D CORP.
UD340
UD345
CIRCUIT SCHEMATIC
EIGHT CHANNEL MONITOR
C20204 A
12-28-86
JS

FIG. 3.0



DATE	SYM	REVISION RECORD	AUTH	DR	CK
		NEW BOARD			

* 1% METAL FILM - RN55

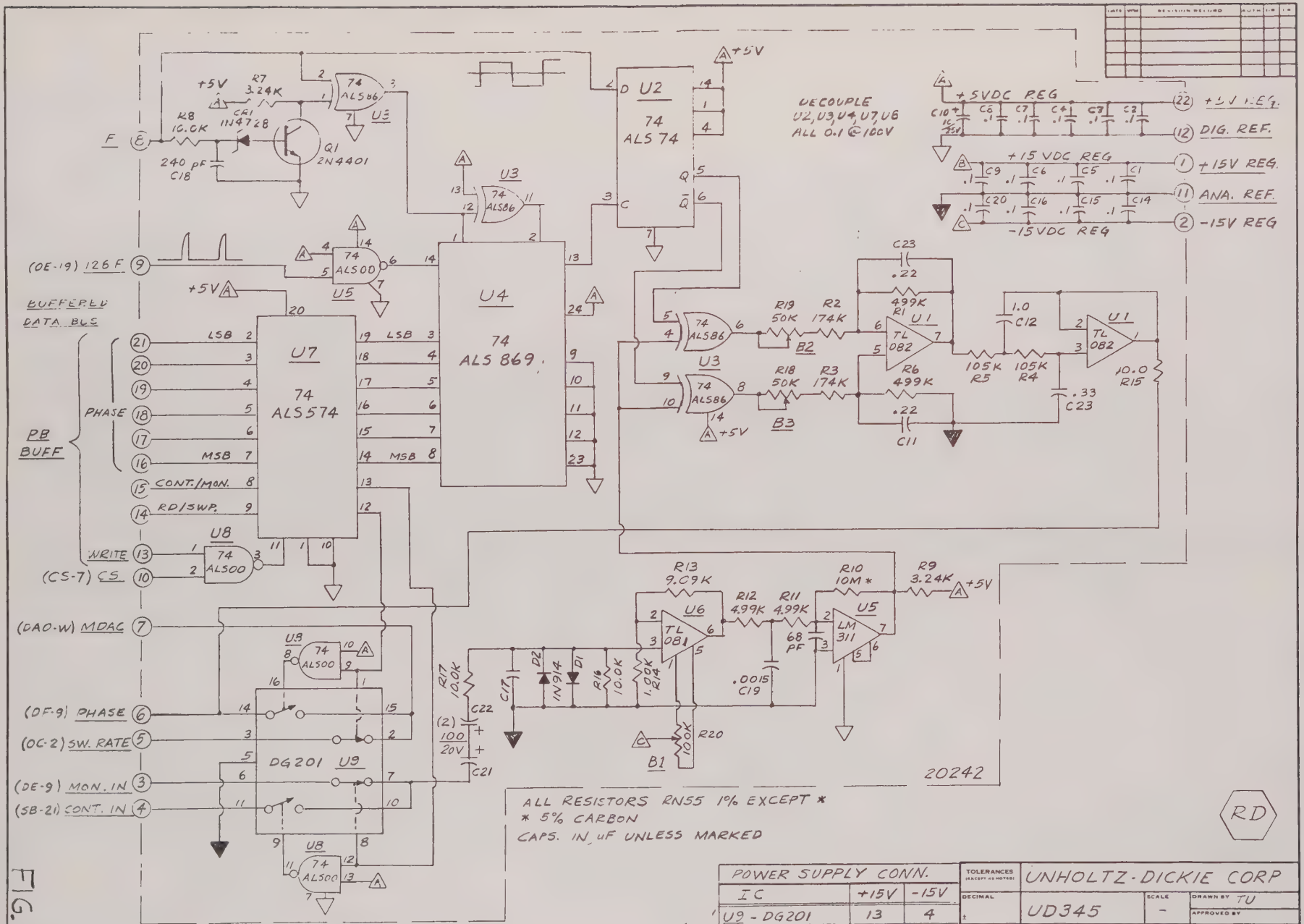
** 4% CAPACITOR (SELECTED)

*** CAPACITOR (2%)

DC

TOLERANCES (EXCEPT AS NOTED)	U-D CORP		
DECIMAL ±	UD 340 UD 345	SCALE	DRAWN BY AJ; APPROVED BY
FRACTIONAL ±	TITLE BOARD LAYOUT EIGHT CHANNEL MONITOR		
ANGULAR ±	DATE 1-17-89	DRAWING NUMBER B20234	

FIG. 8.7



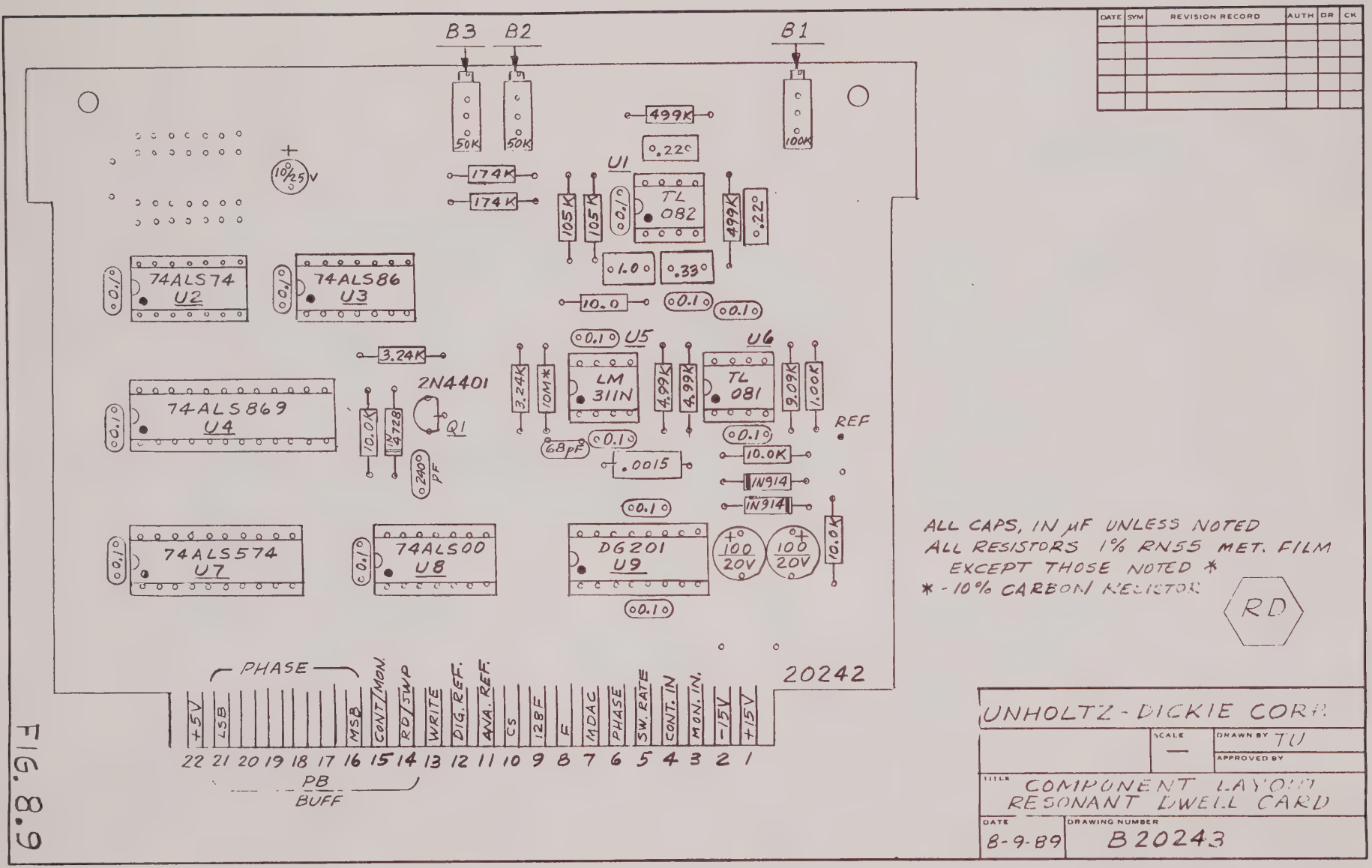
ALL RESISTORS RN55 1% EXCEPT *
* 5% CARBON
CAPS. IN uF UNLESS MARKED

RD

POWER SUPPLY CONN.		
IC	+15V	-15V
U9 - DG201	13	4
U6 - TL081	7	4
U5 - LM311	8	4
U1 - TL082	8	4

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP	
DECIMAL ±	UD345	SCALE - / DRAWN BY TU / APPROVED BY
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC RESONANT DWELL CARD	
ANGULAR ±	DATE 5-8-89	DRAWING NUMBER C20241

FIG. 8.8



DATE	SYM	REVISION RECORD	AUTH	DR	CK

ALL CAPS, IN μF UNLESS NOTED
ALL RESISTORS 1% RN55 MET. FILM
EXCEPT THOSE NOTED *
* - 10% CARBON RESISTOR

RD

UNHOLTZ-DICKIE CORP.

SCALE	DRAWN BY	APPROVED BY
—	TU	

TITLE: COMPONENT LAYOUT RESONANT DWELL CARD

DATE	DRAWING NUMBER
8-9-89	B20243

FIG. 8.9

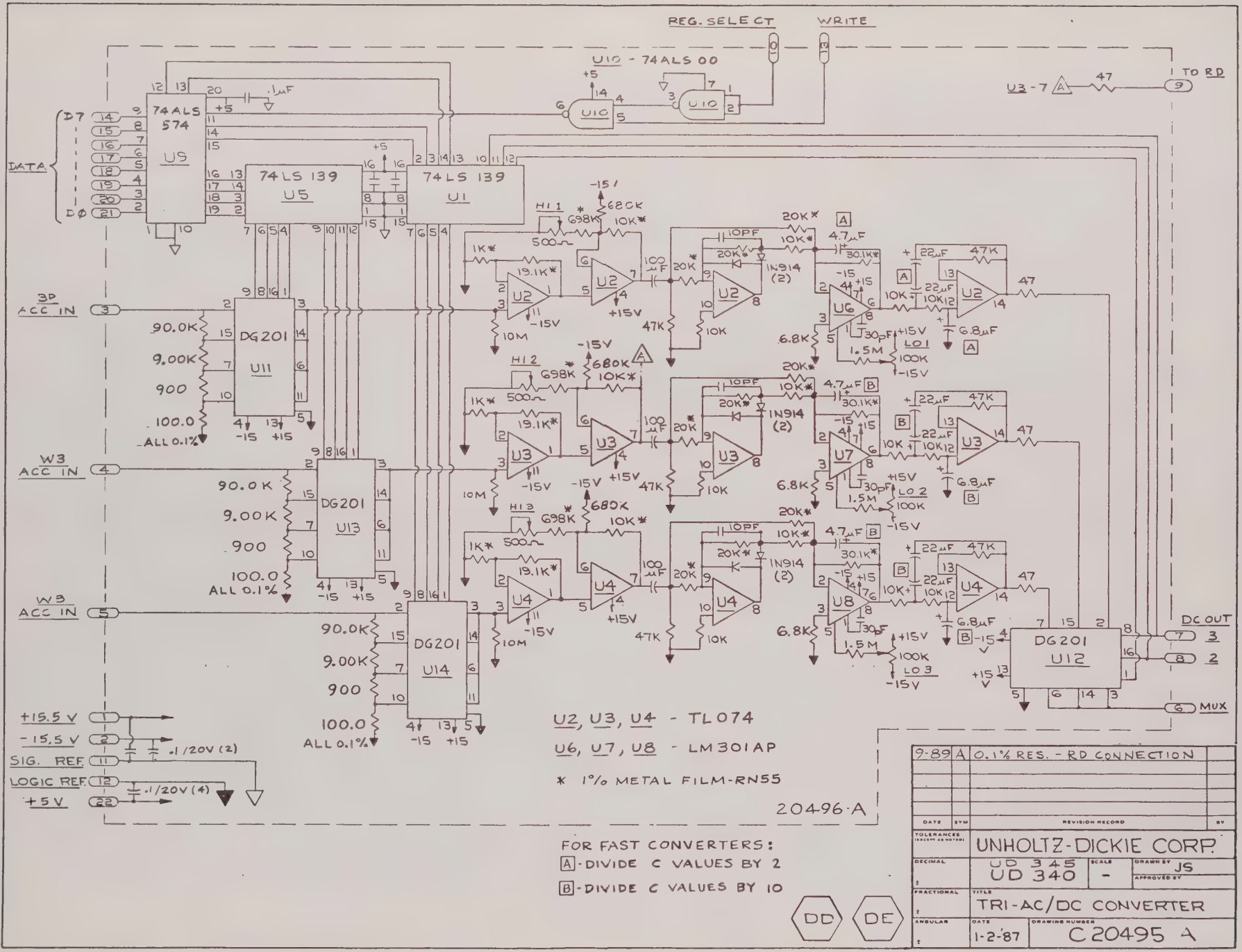

REG. SELECT
WRITE
U10 - 74ALS00
TO RD
DATA
D7
D0
74ALS 574 U9
74LS139 U5
74LS139 U1
.1μF
+5
3P ACC IN
W3 ACC IN
W3 ACC IN
DG201 U11
DG201 U13
DG201 U14
90.0K
9.00K
900
100.0
ALL 0.1%
-15
+15
H11
H12
H13
680K
698K
10K*
500
1K*
19.1K*
10M
100μF
20K*
47K
10K
10PF
IN914 (2)
4.7μF
30.1K*
22μF
47K
6.8K
1.5M
30pF
100K
6.8μF
LO1
LO2
LO3
U2
U3
U4
U6
U7
U8
DG201 U12
DC OUT
MUX
+15.5 V
-15.5 V
SIG. REF
LOGIC REF
+5V
.1/20V (2)
.1/20V (4)
U2, U3, U4 - TL074
U6, U7, U8 - LM301AP
* 1% METAL FILM-RN55
20496-A
FOR FAST CONVERTERS:
A - DIVIDE C VALUES BY 2
B - DIVIDE C VALUES BY 10
DD
DE
9-89 A 0.1% RES. - RD CONNECTION
DATE BY REVISION RECORD BY
UNHOLTZ-DICKIE CORP.
UD 345
UD 340
SCALE -
DRAWN BY JS
APPROVED BY
TRI-AC/DC CONVERTER
DATE 1-2-87
DRAWING NUMBER C20495 A

FIG. 8.10

DATE	BY	REVISION RECORD	AUTH	OR	CK
6/86	A	P.U. 7 & 9 + LAT-N	LEM		
9/89	B	0.1% RES - RD CHT	TU		

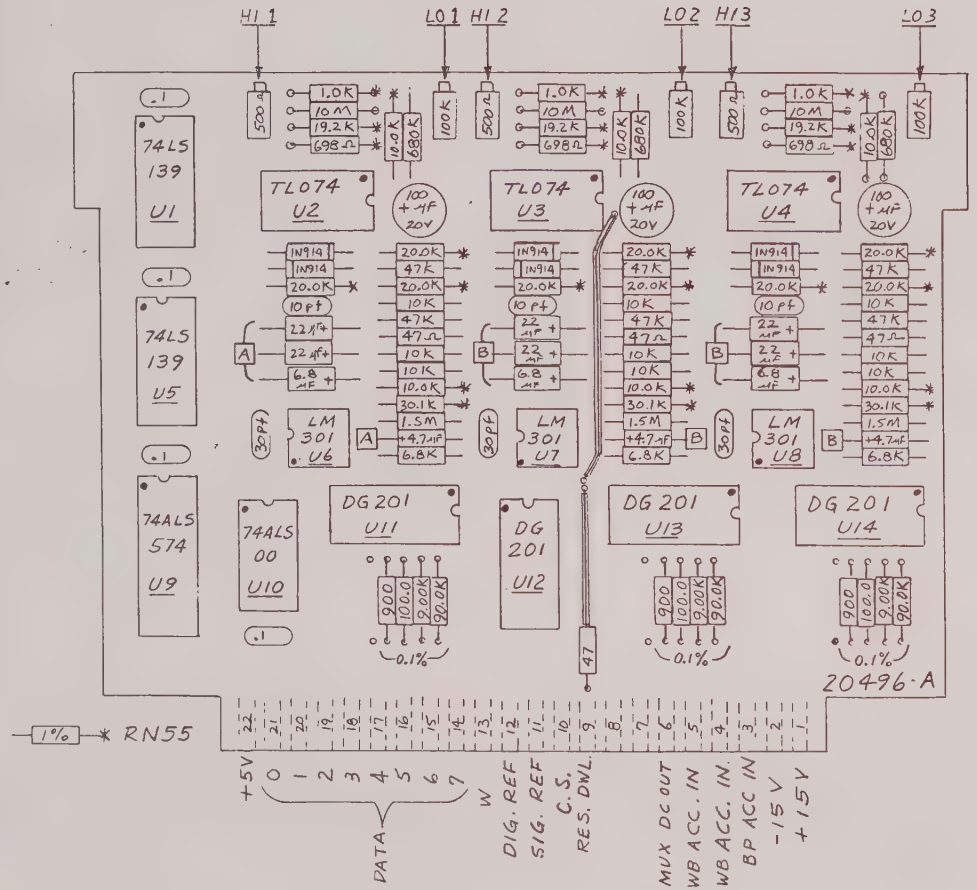


FIG. 8.1

FOR FAST CONVERTERS:
A - DIVIDE C VALUES BY 2
B - DIVIDE C VALUES BY 10

DD DE

TOLERANCES (UNLESS AS NOTED)	UNHOLTZ-DICKIE CORP
DECIMAL :	UD 340 UD 345
SCALE —	DRAWN BY TU/LEM
FRACTIONAL :	APPROVED BY
TITLE	COMPONENT LAYOUT TRI AC-DC CONVERTER
ANGULAR :	DATE 9-27-89
DRAWING NUMBER	C20474 B

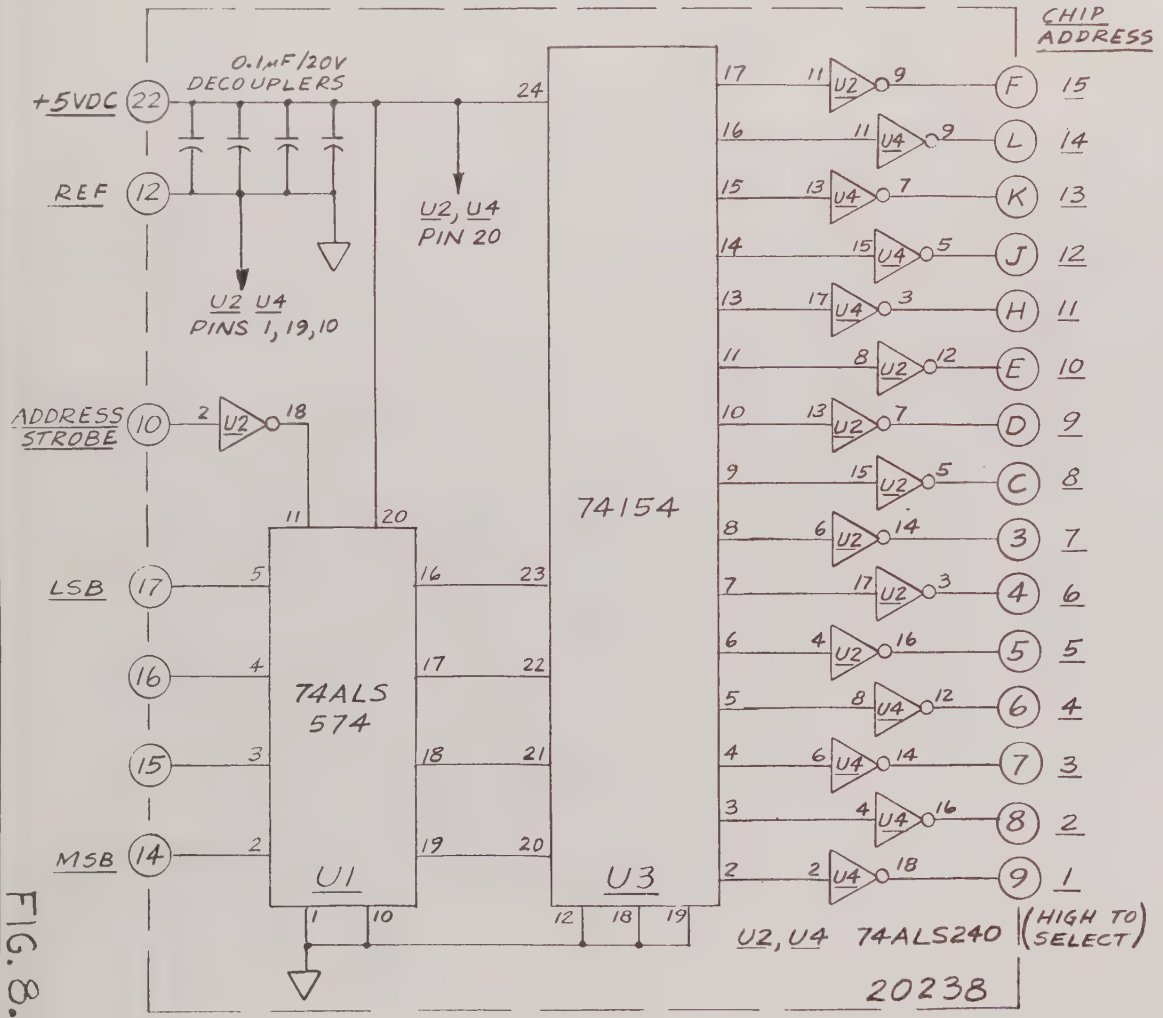


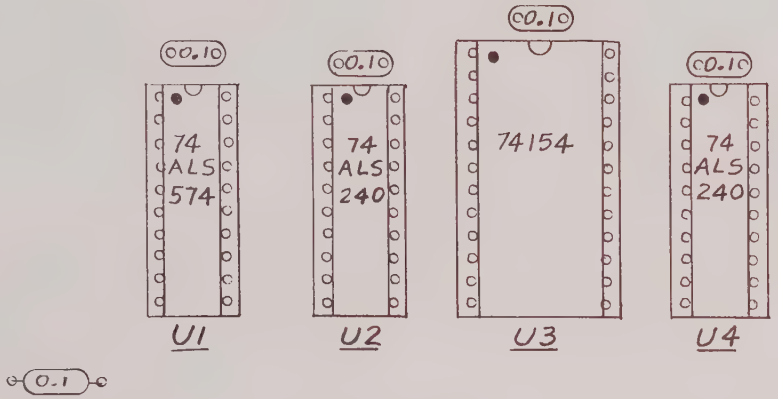
FIG. 8.12

DATE	SYM	REVISION RECORD	AUTH	DR	CK

CS

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ± —		SCALE —	DRAWN BY TU APPROVED BY
FRACTIONAL ± —	TITLE CIRCUIT SCHEMATIC CHIP SELECT CARD		
ANGULAR ± —	DATE 2/13/89	DRAWING NUMBER B20237	

DATE	SYM	REVISION RECORD	AUTH	DR	CK



20238

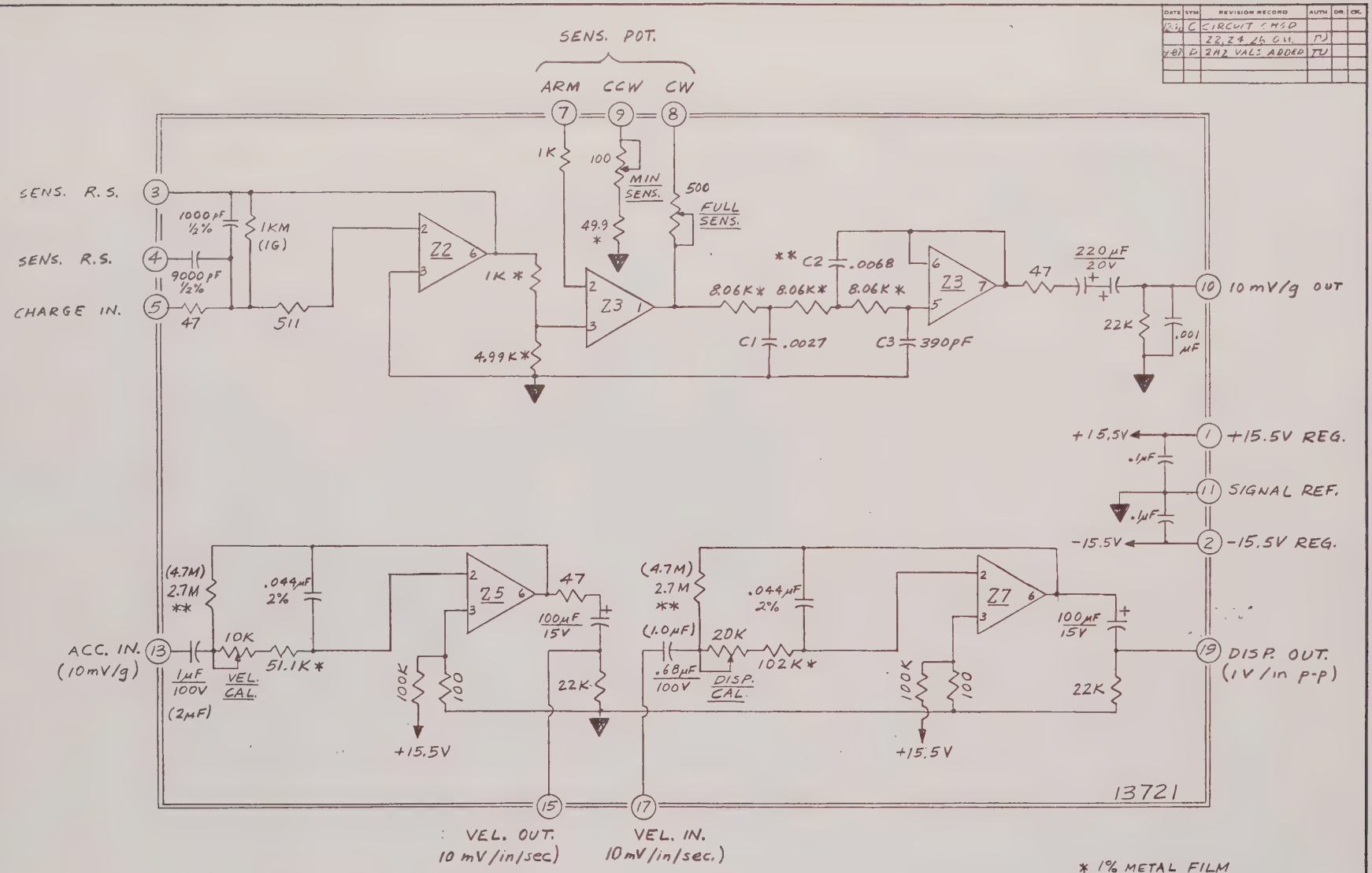
Z — REAR — A
22 — FRONT — 1

CAPS IN μF

CS

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ± —	UD340 UD345	SCALE —	DRAWN BY TU / APPROVED BY
FRACTIONAL ± —	TITLE COMPONENT LAYOUT CHIP SELECT CARD		
ANGULAR ± —	DATE 5-4-89	DRAWING NUMBER B20239	

FIG 8.13



DATE	SYM	REVISION RECORD	AUTH	DR.	CK.
2-10	C	CIRCUIT CHGD			
		Z2, Z4 ADD CAP.	PJ		
4-87	D	2Hz VALS ADDED	TU		

* 1% METAL FILM
** SHUNTED
( ) - VALUES FOR 2Hz OPER.

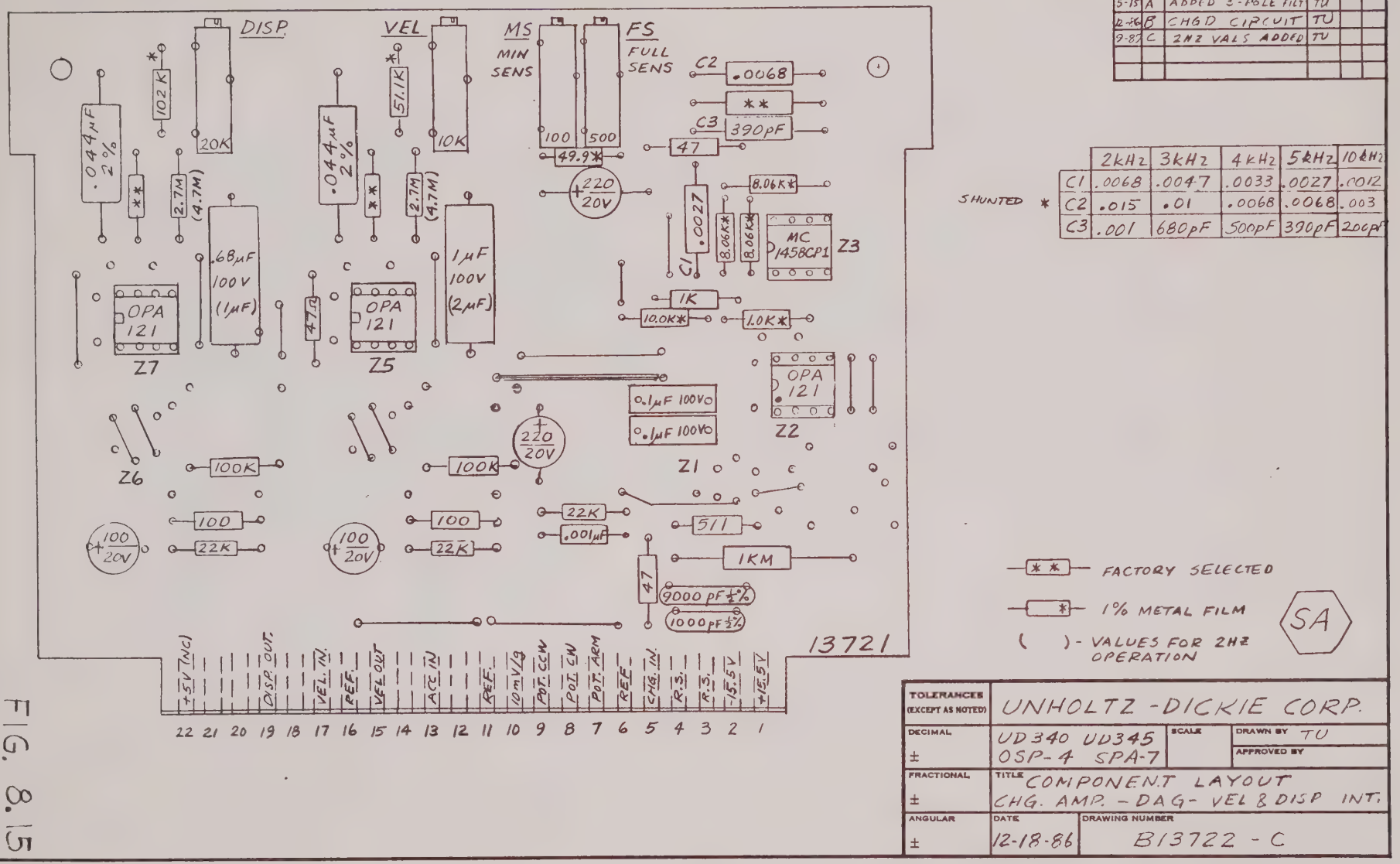
	2 kHz	3kHz	4kHz	5kHz	10kHz
C_1	.0068	.0047	.0033	.0027	.0012
C_2	.015	.01	.0068	.0068	.003
C_3	.001	680pF	500pF	390pF	200pF

		PIN	
IC	TYPE	+16.5V	-16.5V
Z1,5,7	OPA 121	7	4
Z3	MC1458CP1	8	4
Z2,4,6	NOT USED		

SA

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.	
DECIMAL ±	UD 340 UD345 OSP-4 SPA-7	SCALE – DRAWN BY TU APPROVED BY
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC CHG. AMP. - DAG - INT. CARD	
ANGULAR ±	DATE 12-18-86	DRAWING NUMBER C13737-D

FIG. 8.14



DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
5-15	A	ADDED 2-POLE FILT	TU		
2-16	B	CHGD CIRCUIT	TU		
9-87	C	2HZ VALS ADDED	TU		

SHUNTED *

	2kHz	3kHz	4kHz	5kHz	10kHz
C1	.0068	.0047	.0033	.0027	.0012
C2	.015	.01	.0068	.0068	.003
C3	.001	680pF	500pF	390pF	200pF

** FACTORY SELECTED

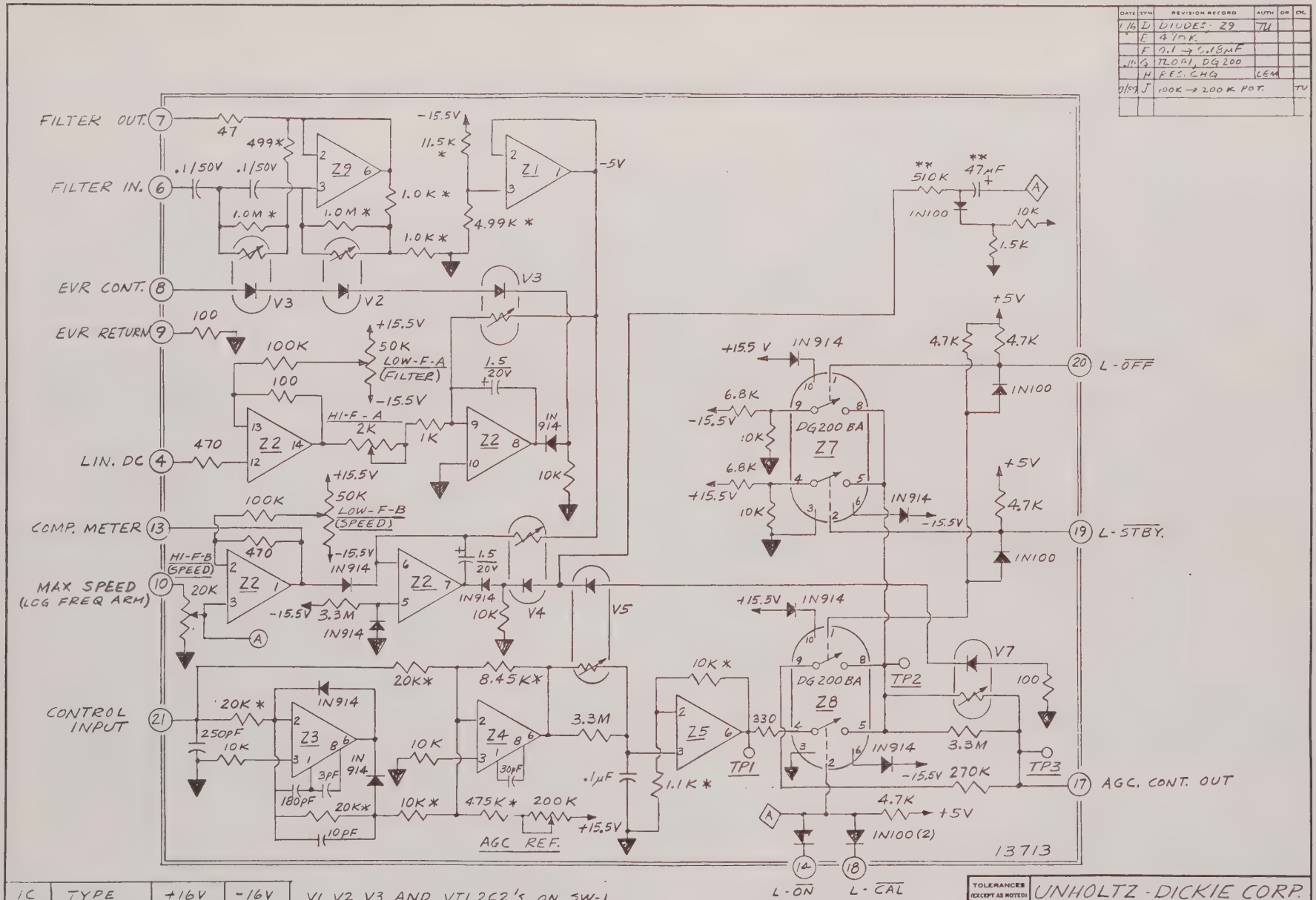
* 1% METAL FILM

( ) - VALUES FOR 2HZ OPERATION

SA

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD340 UD345 OSP-4 SPA-7	SCALE	DRAWN BY TU / APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT CHG. AMP. - DAG - VEL & DISP INT.		
ANGULAR ±	DATE 12-18-86	DRAWING NUMBER B13722 - C	

FIG. 8.15



DATE	SYM	REVISION RECORD	AUTH	DR	CK
1/16	D	DIODES: Z9	TU		
	E	47mK			
	F	0.1 → 0.15μF			
11/6	G	TL081, DG200			
	H	RES. CHG	LEM		
9/89	J	100K → 200K POT.			TU

IC	TYPE	+16V	-16V
Z1	MC1458CP1	8	4
Z2	TL084	4	11
Z3,Z4	LM301AN	7	4
Z5 Z8	TL 081	7	4

V1, V2, V3 AND VTL2C2's ON SW-1 THRU SW-4 ARE MATCHED

V4, V5, V7 ARE MATCHED VTL2C2's

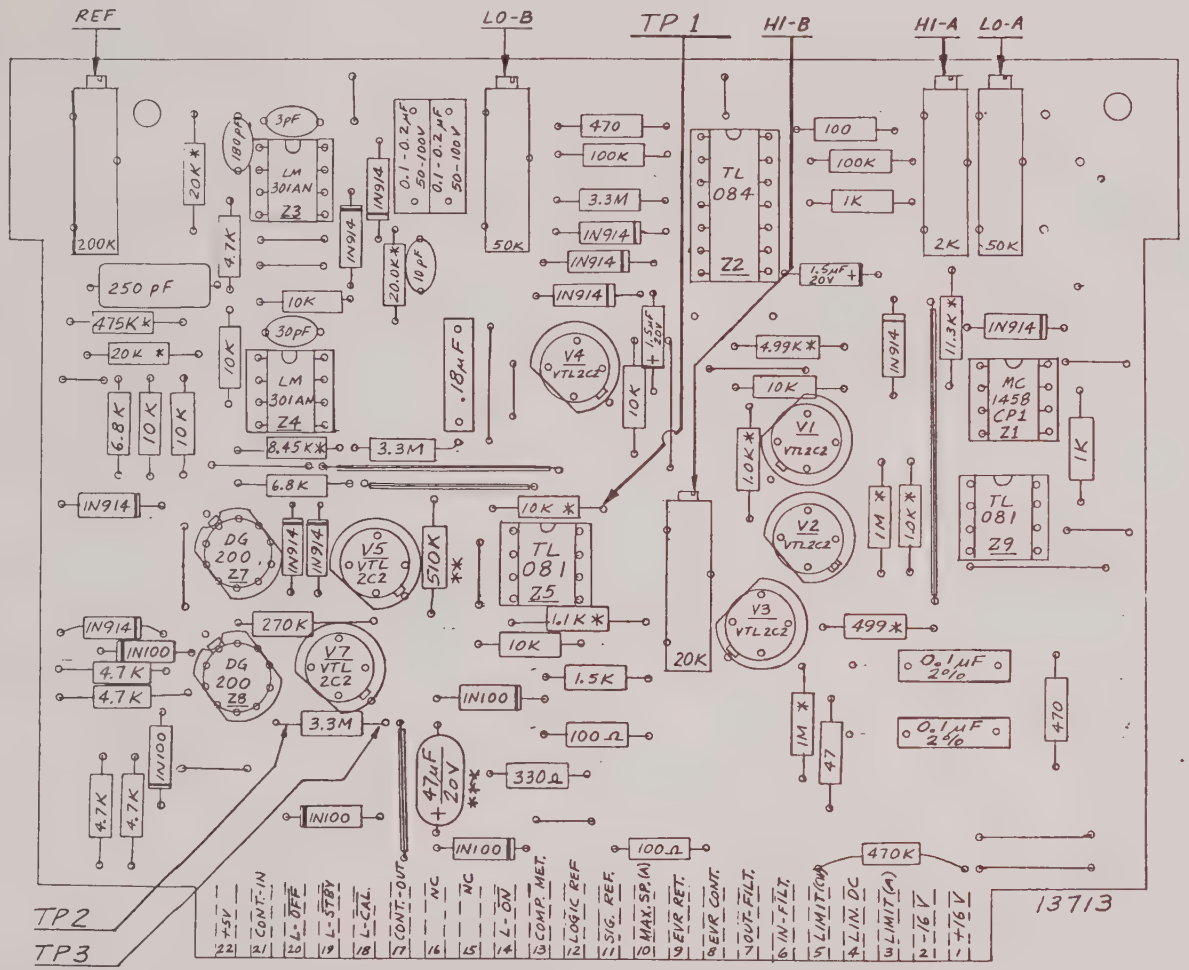
* RN55 1% RESISTOR

** SELECTED VALUES

SB

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.	
DECIMAL ±	UD340 UD345	SCALE — DRAWN BY TU APPROVED BY
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC AGC CONTROL CARD	
ANGULAR ±	DATE 7-30-87	DRAWING NUMBER C13738 J

FIG. 8.16



REVISION RECORD			
5-76	A	PROTO. REV.	TU
7-76	B C	CIR. CHGD	TU

9-89	F	562K → 475K 100K → 200K POT	TU
12-16	E	OP AMPS CHGD	TU

SB

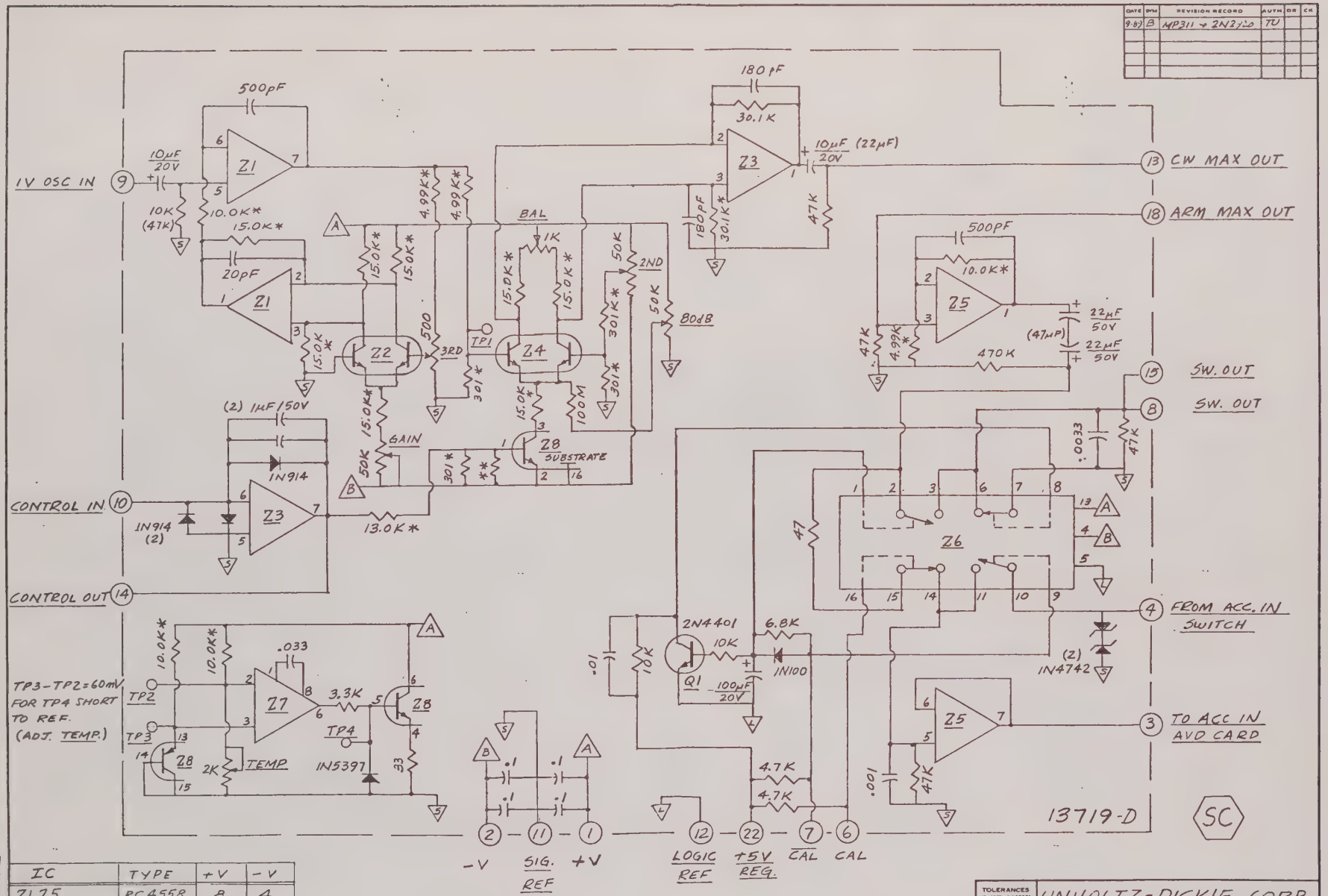
UNHOLTZ - DICKIE CORP

SPA-7UD349
OSP-4 UD340

COMPONENT LAYOUT
AGC CONTROL CARD

D13714 F

FIG. 8.17



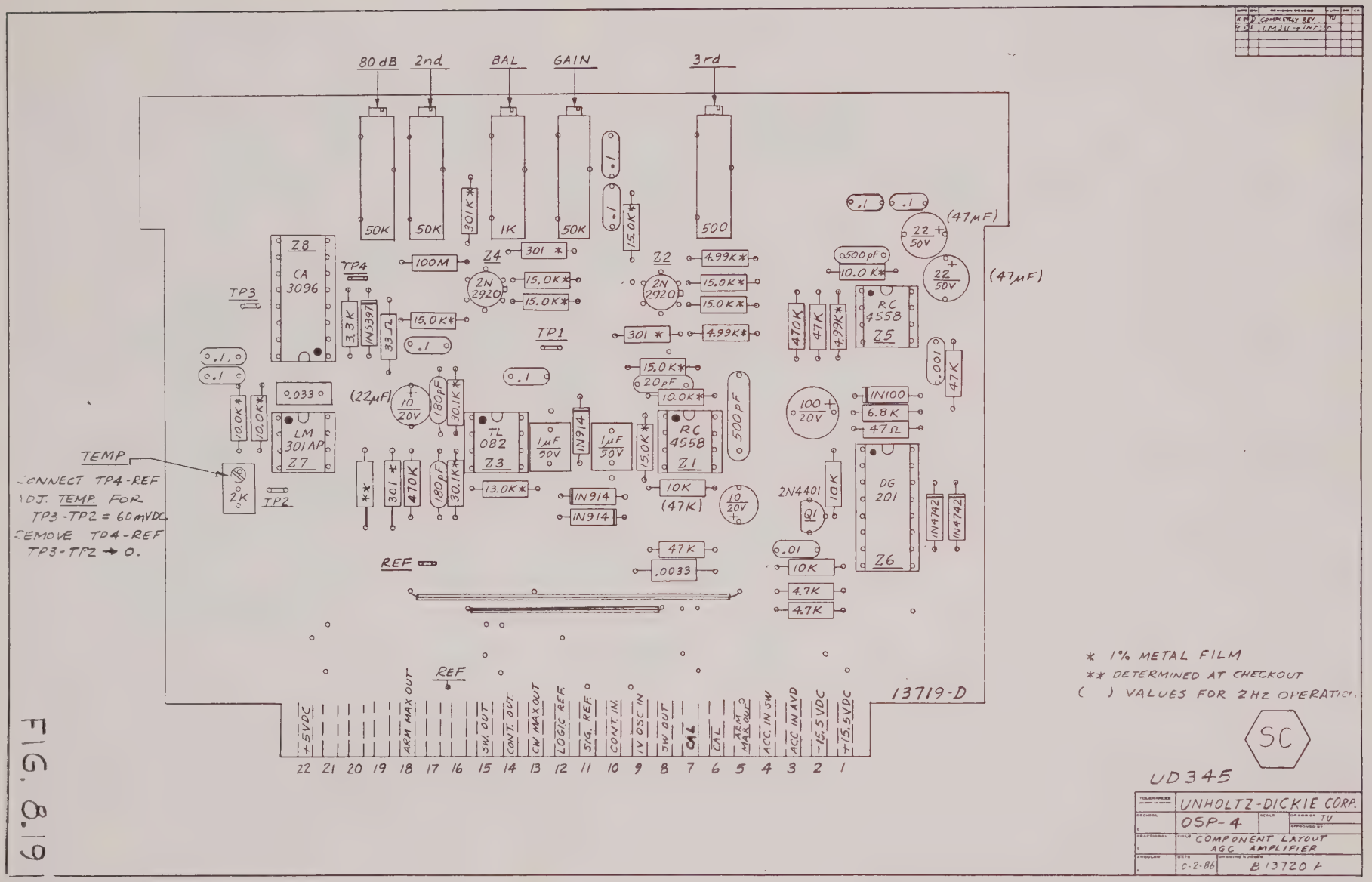
IC	TYPE	+V	-V
Z1,Z5	RC4558	8	4
Z2,Z4	2N2920	-	-
Z3	TL082	8	4
Z6	DG201	13	4
Z7	LM301	7	4
Z8	CA3096	-	-

( )- VALUES FOR 2Hz OPERATION
* 1% METAL FILM RN55
** FACTORY SELECTED
V- 15 TO 16.5 VDC

DATE	BY	REVISION RECORD	AUTH	DR	CK
9-82	B	MP311 → 2N2920	TU		

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP
DECIMAL ±	UD340 UD345 OSP-4 SPA-7
SCALE —	DRAWN BY TU
FRACTIONAL ±	APPROVED BY
TITLE	CIRCUIT SCHEMATIC AGC AMPL. CARD
ANGULAR ±	DATE 12-17-82
DRAWING NUMBER	C20201 B

FIG. 8.18



* 1% METAL FILM

** DETERMINED AT CHECKOUT

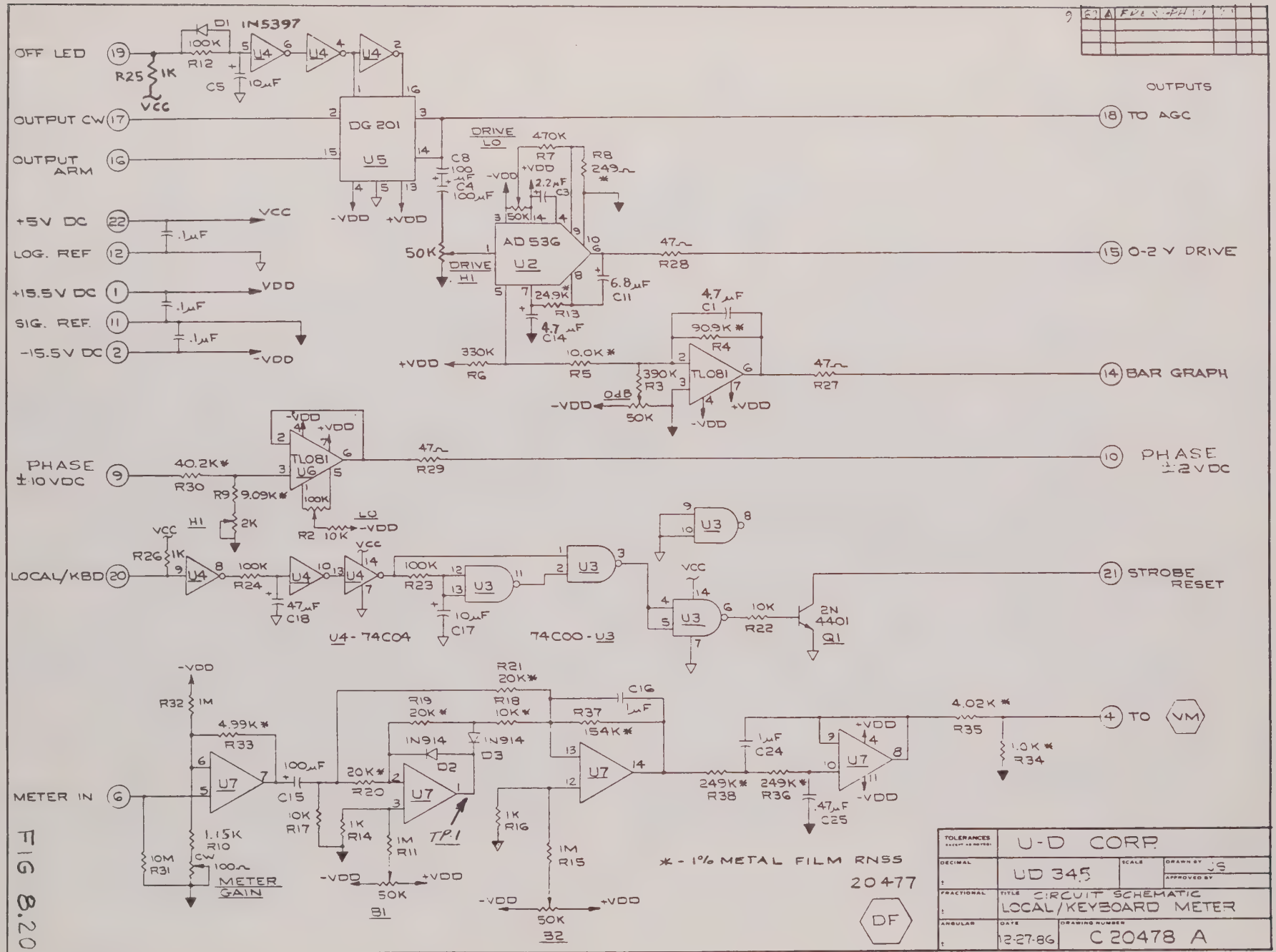
( ) VALUES FOR 2Hz OPERATION

SC

UD345

UNHOLTZ-DICKIE CORP.	
OSP-4	DRAWN BY TU
COMPONENT LAYOUT AGC AMPLIFIER	
10-2-86	B13720 A

FIG. 8.19


OFF LED
OUTPUT CW
OUTPUT ARM
+5V DC
LOG. REF
+15.5V DC
SIG. REF.
-15.5V DC
D1 IN5397
R12
R25 1K
VCC
C5 10µF
DG 201
U5
C8 100µF
C4 100µF
DRIVE LO
R7 470K
R8 249Ω
C3 2.2µF
AD 536
U2
50K
DRIVE HI
6.8µF C11
R13 24.9K
4.7µF C14
47Ω R28
OUTPUTS
18 TO AGC
15 0-2 V DRIVE
14 BAR GRAPH
C1 4.7µF
90.9K R4
330K R6
10.0K R5
390K R3
TL081
47Ω R27
0dB
50K
PHASE ±10 VDC
R30 40.2K
R9 9.09K
100K
R2 10K
2K
47Ω R29
10 PHASE ±2 VDC
LOCAL/KBD
R26 1K
R24 100K
C18 47µF
R23 100K
C17 10µF
U4 - 74C04
74C00 - U3
21 STROBE RESET
R22 10K
2N 4401 Q1
METER IN
R32 1M
4.99K R33
C15 100µF
R21 20K*
R19 20K*
R18 10K*
R37 154K*
C16 1µF
IN914 D2
IN914 D3
20K R20
10K R17
1K R14
1M R11
TP1
1K R16
1M R15
249K R38
249K R36
C24 1µF
C25 .47µF
4.02K R35
1.0K R34
4 TO VM
10M R31
1.15K R10 CW
100Ω METER GAIN
B1
B2
50K
* - 1% METAL FILM RN55
20477
DF
U-D CORP
UD 345
CIRCUIT SCHEMATIC
LOCAL/KEYBOARD METER
C 20478 A
12-27-86
FIG 8.20

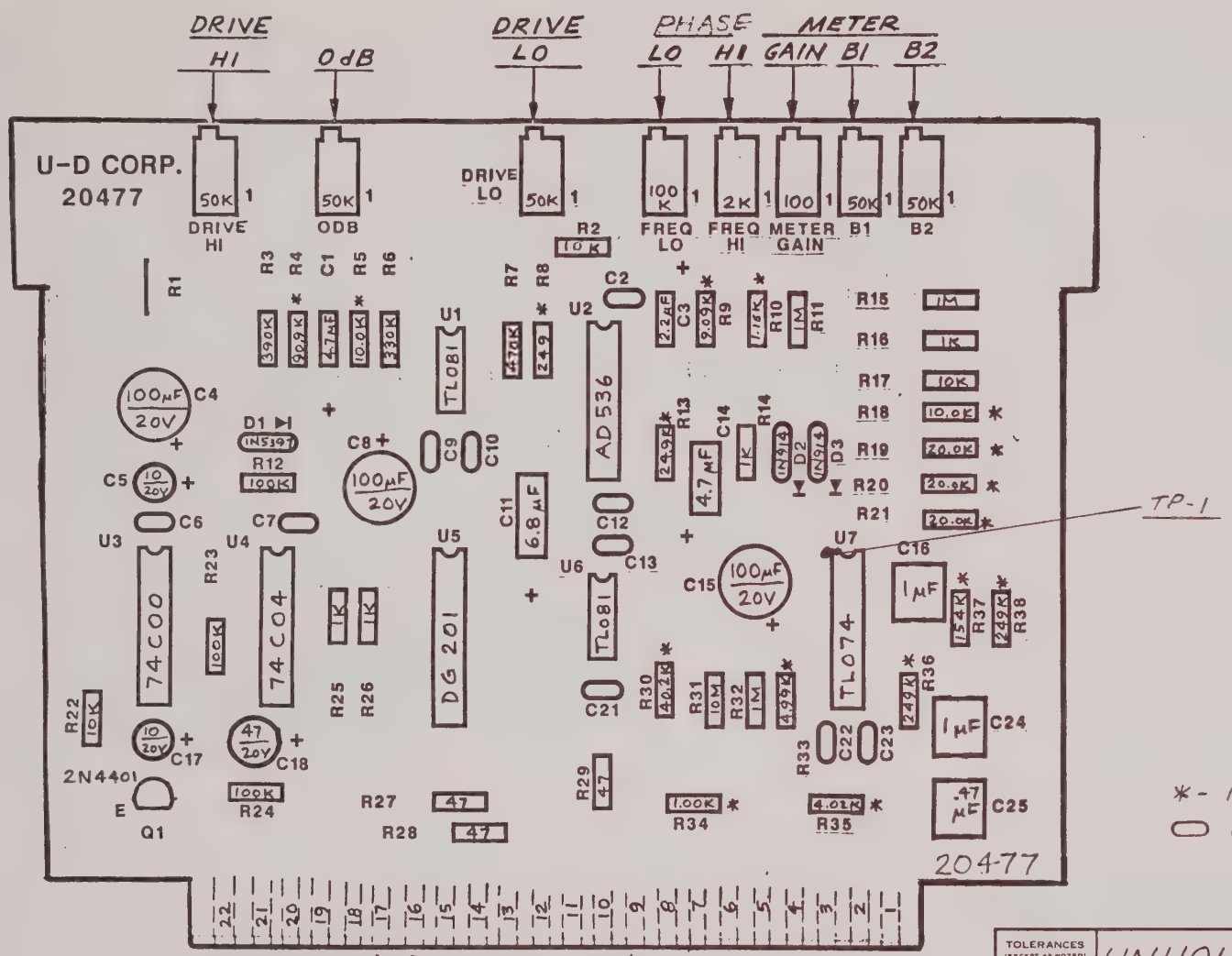
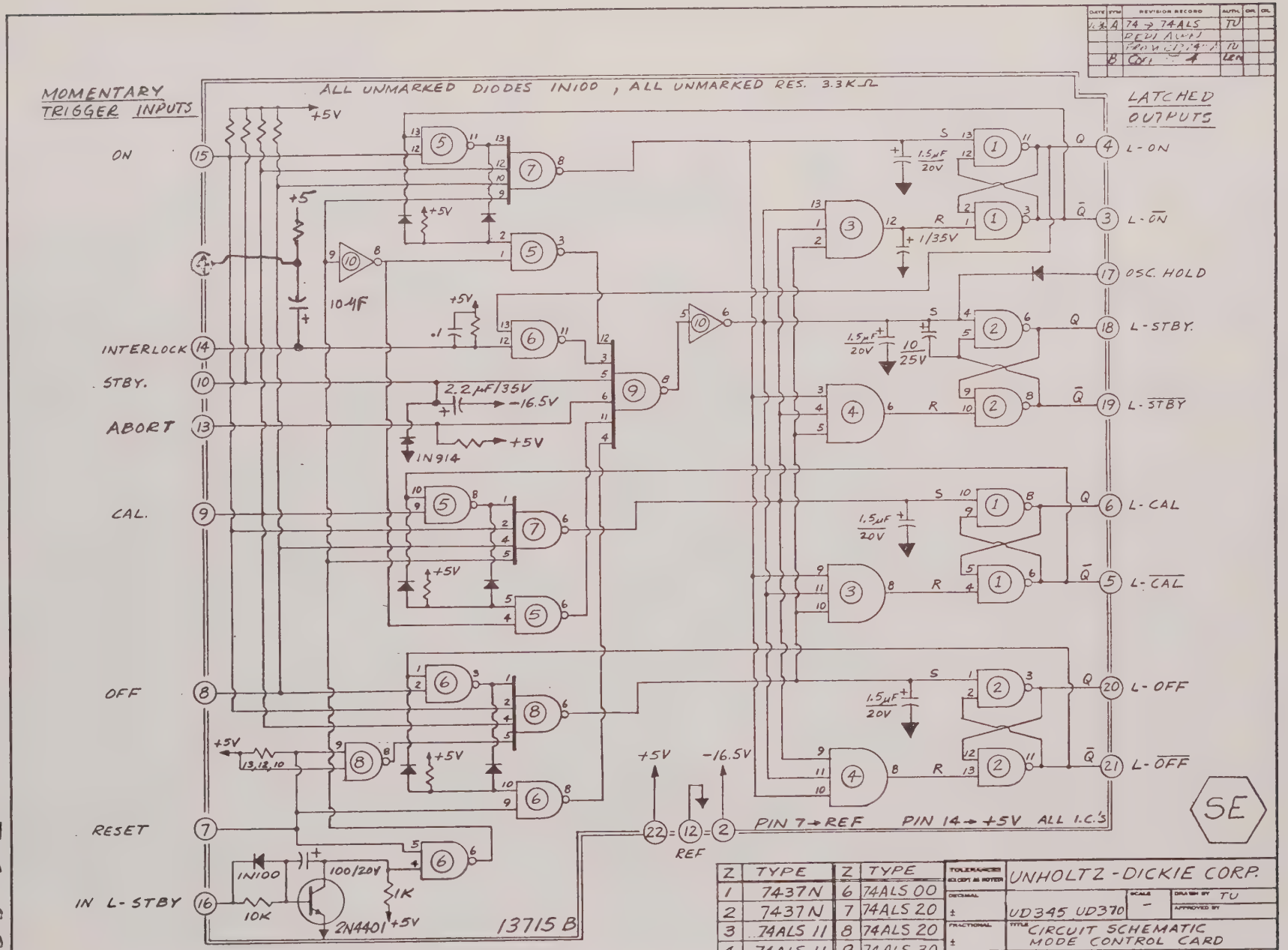


FIG. 8.21

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD345	SCALE	DRAWN BY TU
			APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT LOCAL/KEYBOARD-METER CARD		
ANGULAR ±	DATE 12-29-86	DRAWING NUMBER A20206 A	

MADE IN U.S.A.



Z	TYPE	Z	TYPE
1	7437N	6	74ALS 00
2	7437N	7	74ALS 20
3	74ALS 11	8	74ALS 20
4	74ALS 11	9	74ALS 30
5	74ALS 00	10	74ALS 04

DATE	SYM	REVISION RECORD	AUTH.
1-22	A	74 → 74ALS	TU
		REVISED PER ECO 1	TU
	B	ECO 1	LEN

TOLERANCES (EXCEPT AS NOTED): DECIMAL ± ; FRACTIONAL ± ; ANGULAR ±

UNHOLTZ-DICKIE CORP.

UD345 UD370 — SCALE — DRAWN BY TU — APPROVED BY

TITLE: CIRCUIT SCHEMATIC MODE CONTROL CARD

DATE 6-26-90 — DRAWING NUMBER B20297 B

SE

FIG. 8.22

DATE	SYM	REVISION RECORD	AUTH	OR	CK
		BIBTAG REDRAWN	TU		
8		ADD JUMPER PN 1	TU		

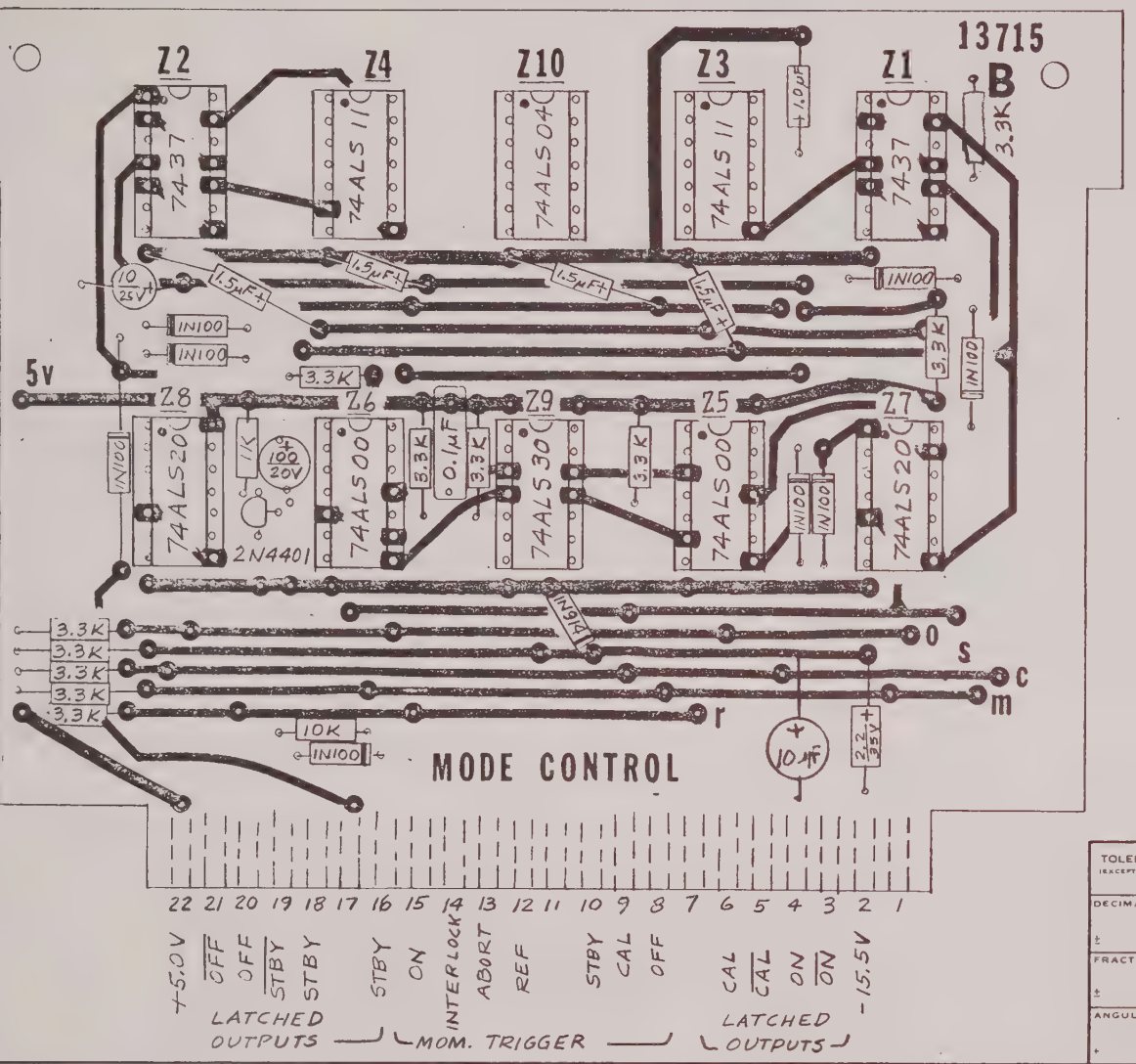
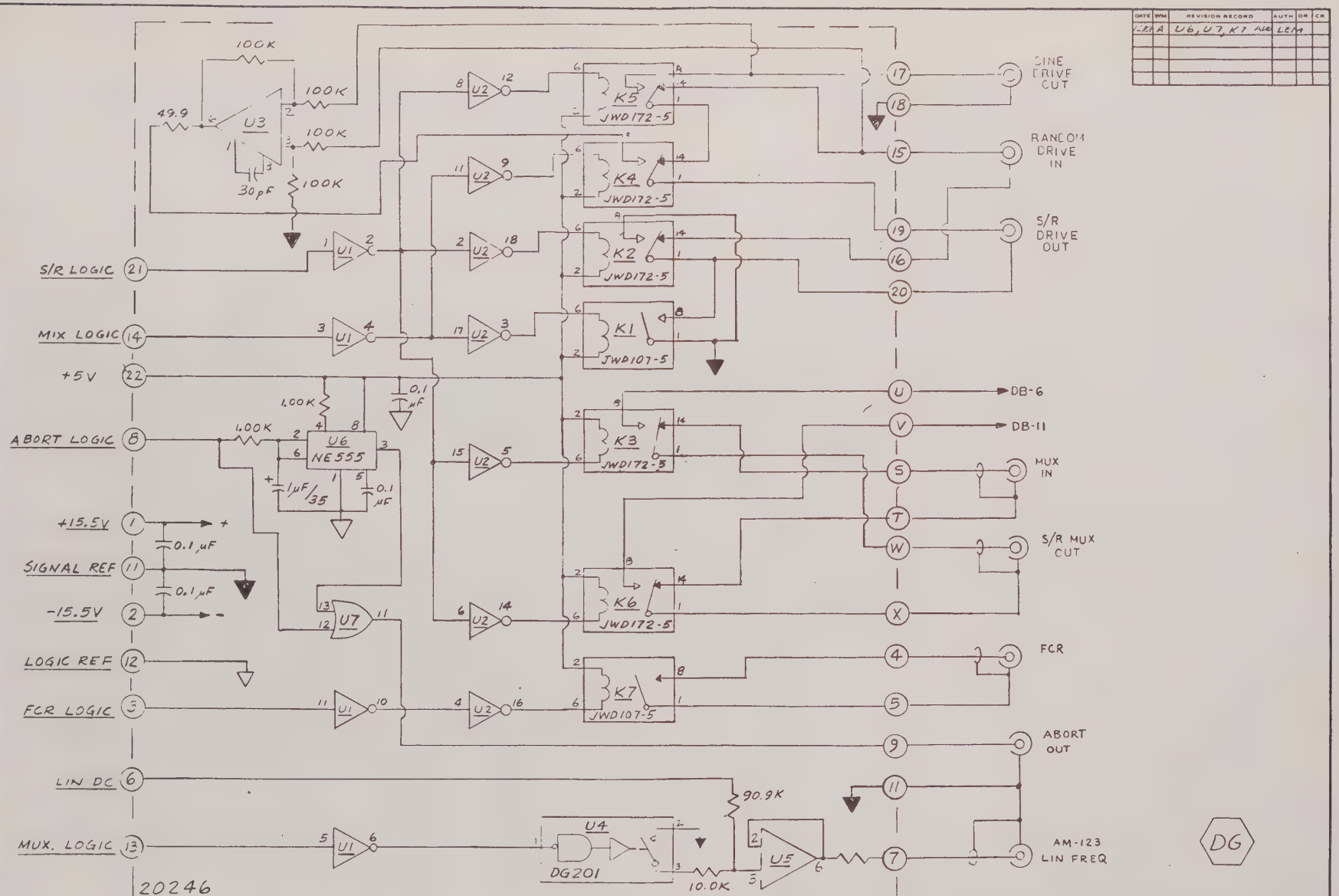


FIG. 8.23

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ± —	UD345 UD370	SCALE —	DRAWN BY TU
			APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT MODE CONTROL CARD		
ANGULAR ±	DATE 6-26-90	DRAWING NUMBER B20298 B	



DATE	BY	REVISION RECORD	AUTH	OR	CR
1/24/74	A	U6, U7, K7 ADD	LEM		

20246

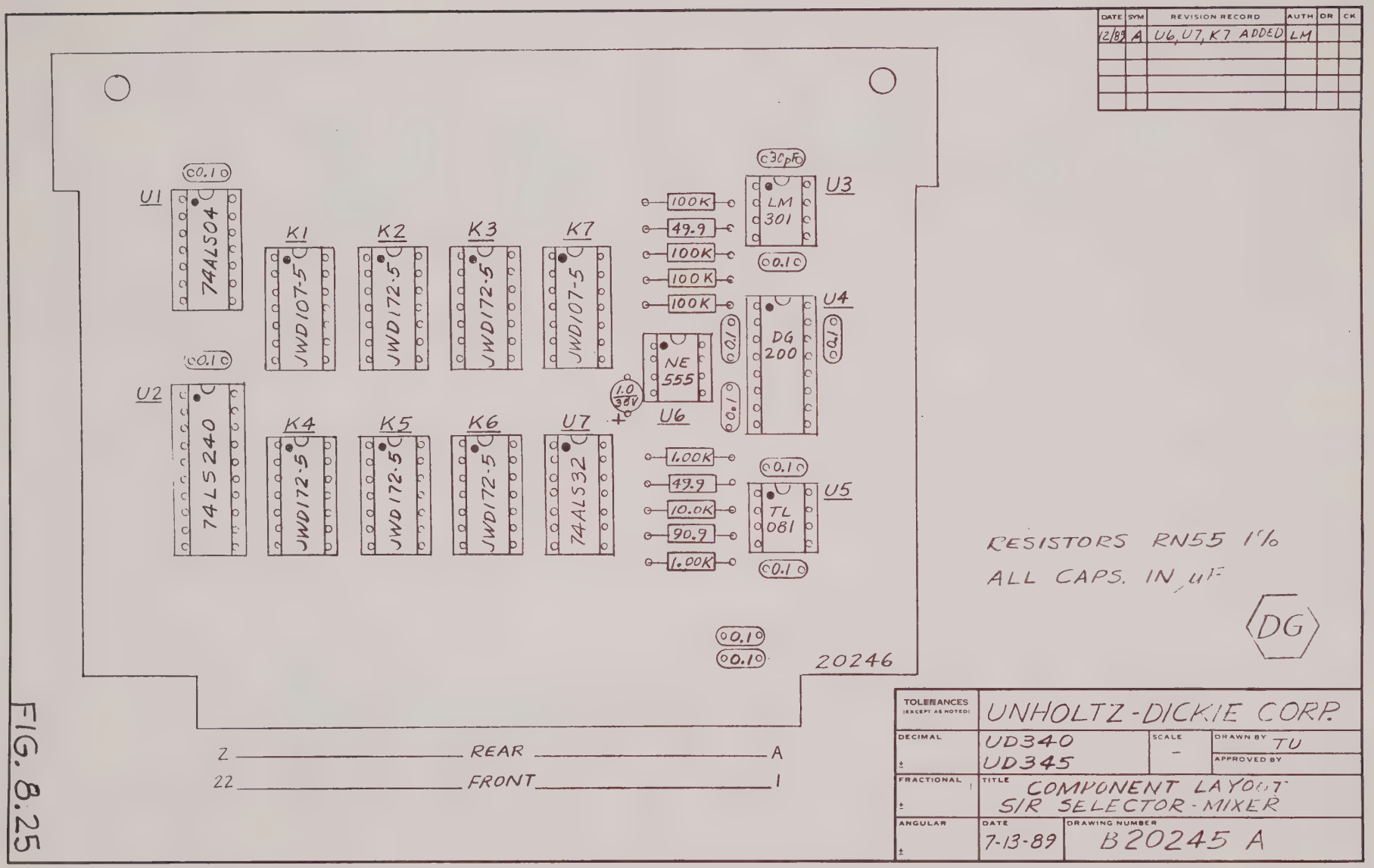
ALL RESISTORS 2N55 1%
ALL LOGIC IC'S DECOUPLED

U	IC	+15V	-15V	+5V	LOGIC REF
U6	NE555	—	—	8	1
U7	74ALS32	—	—	14	7
U5	LF081CD	7	4	-	-

U	IC	+15V	-15V	+5V	LOGIC REF
U3	LM301AN	7	4	-	-
U4	DG201	13	4		5
U2	74LS240			20	1,10,19
U1	74ALS04			14	7

TOLERANCES (EXCEPT AS NOTED)	UNIVOLTZ - DICKIE CORP
DECIMAL -	UD 340
SCALE -	DRAWN BY TU
APPROVED BY	
FRACTIONAL -	TITLE CIRCUIT SCHEMATIC S/R SELECTOR-MIXER
ANGULAR -	DATE 5-10-74
DRAWING NUMBER	C 20244 A

FIG. 8.24



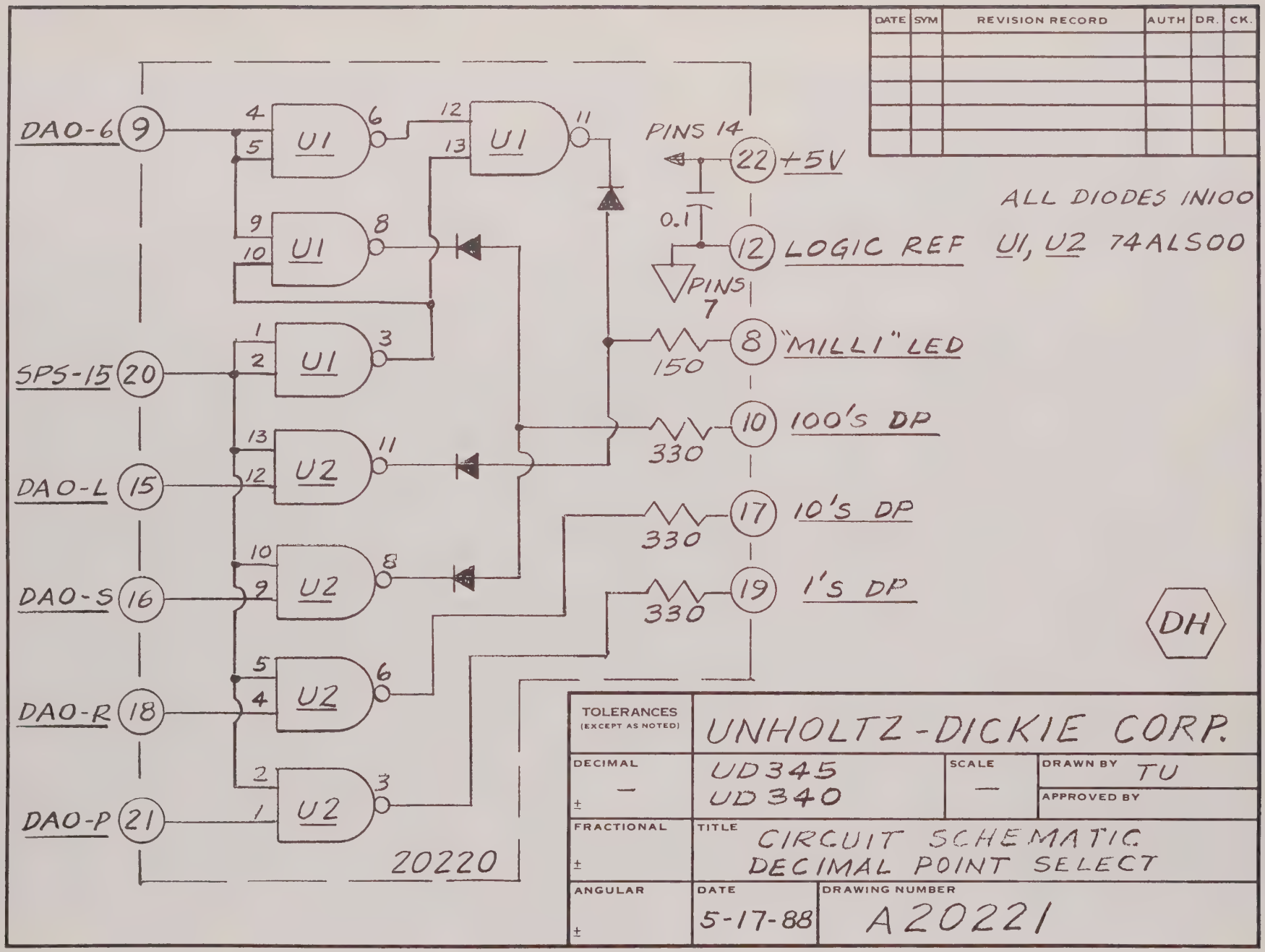
DATE	SYM	REVISION RECORD	AUTH	DR	CK
12/89	A	U6, U7, K7 ADDED	LM		

RESISTORS RN55 1%
ALL CAPS. IN uF

DG

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD340 UD345	SCALE –	DRAWN BY TU APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT S/R SELECTOR-MIXER		
ANGULAR ±	DATE 7-13-89	DRAWING NUMBER B20245 A	

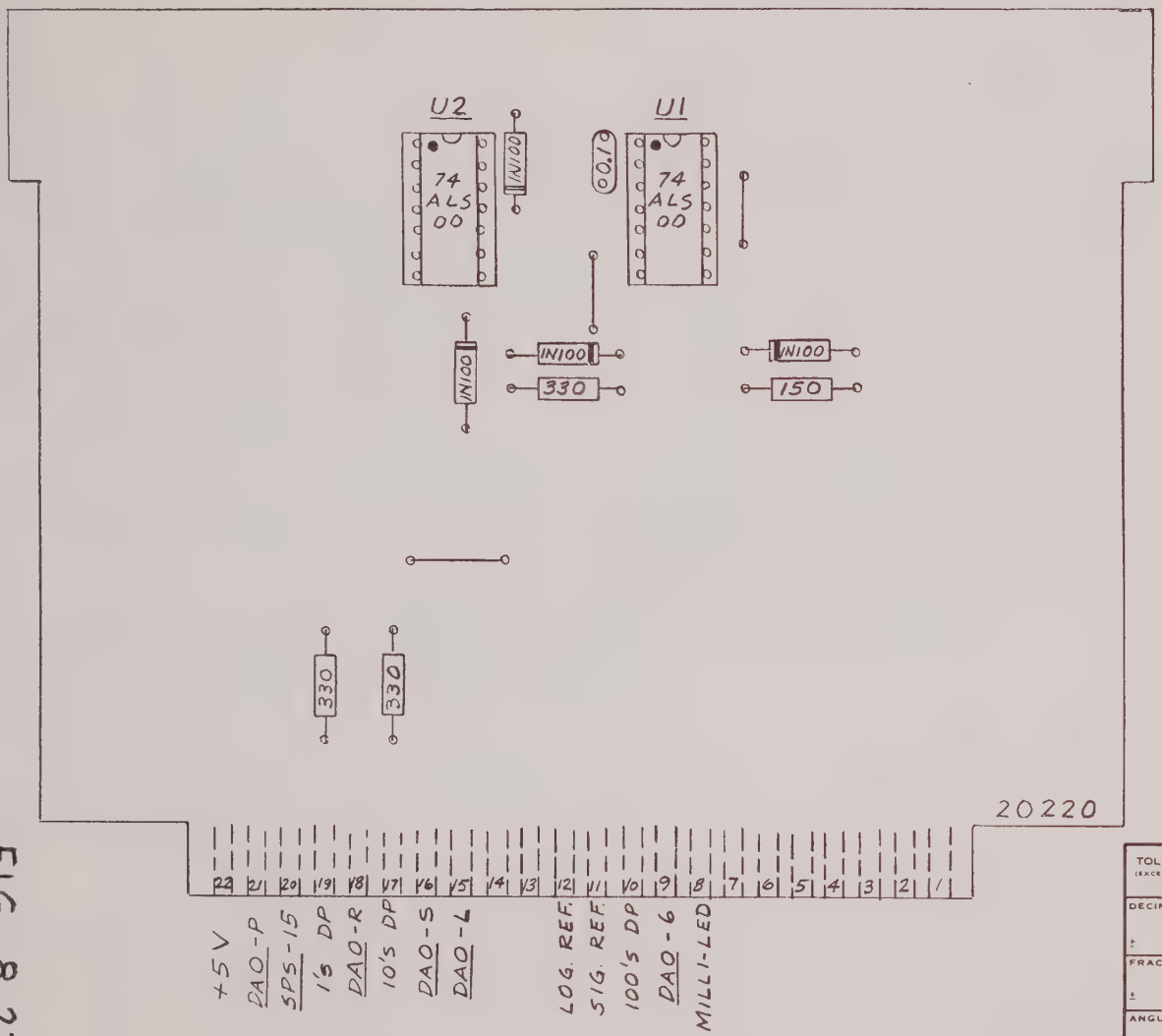
FIG. 8.25



DATE	SYM	REVISION RECORD	AUTH	DR.	CK.

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ± —	UD345 UD340	SCALE —	DRAWN BY TU APPROVED BY
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC DECIMAL POINT SELECT		
ANGULAR ±	DATE 5-17-88	DRAWING NUMBER A20221	

FIG. 8.26

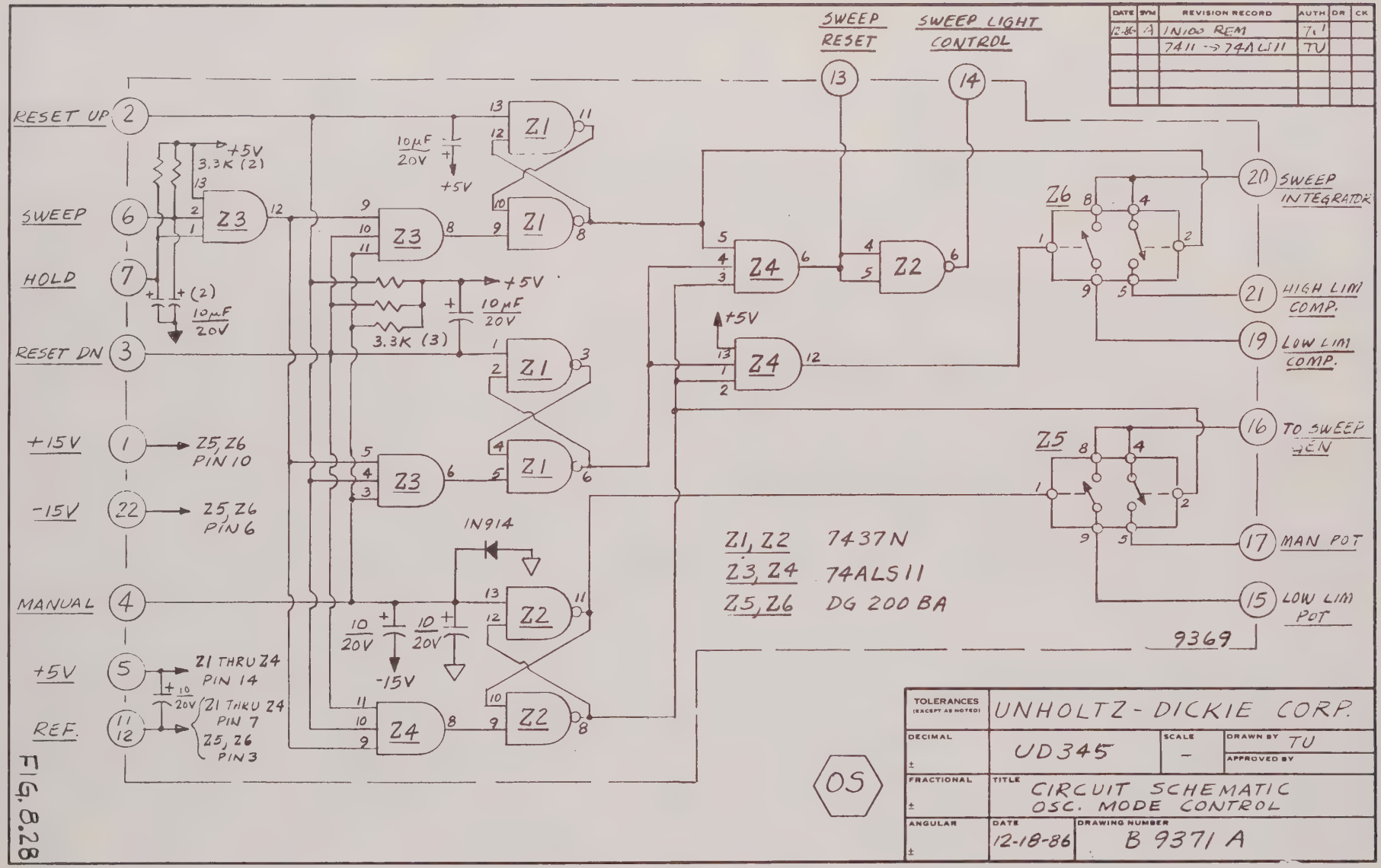


DATE	SYM	REVISION RECORD	AUTH	DR	CK

DH

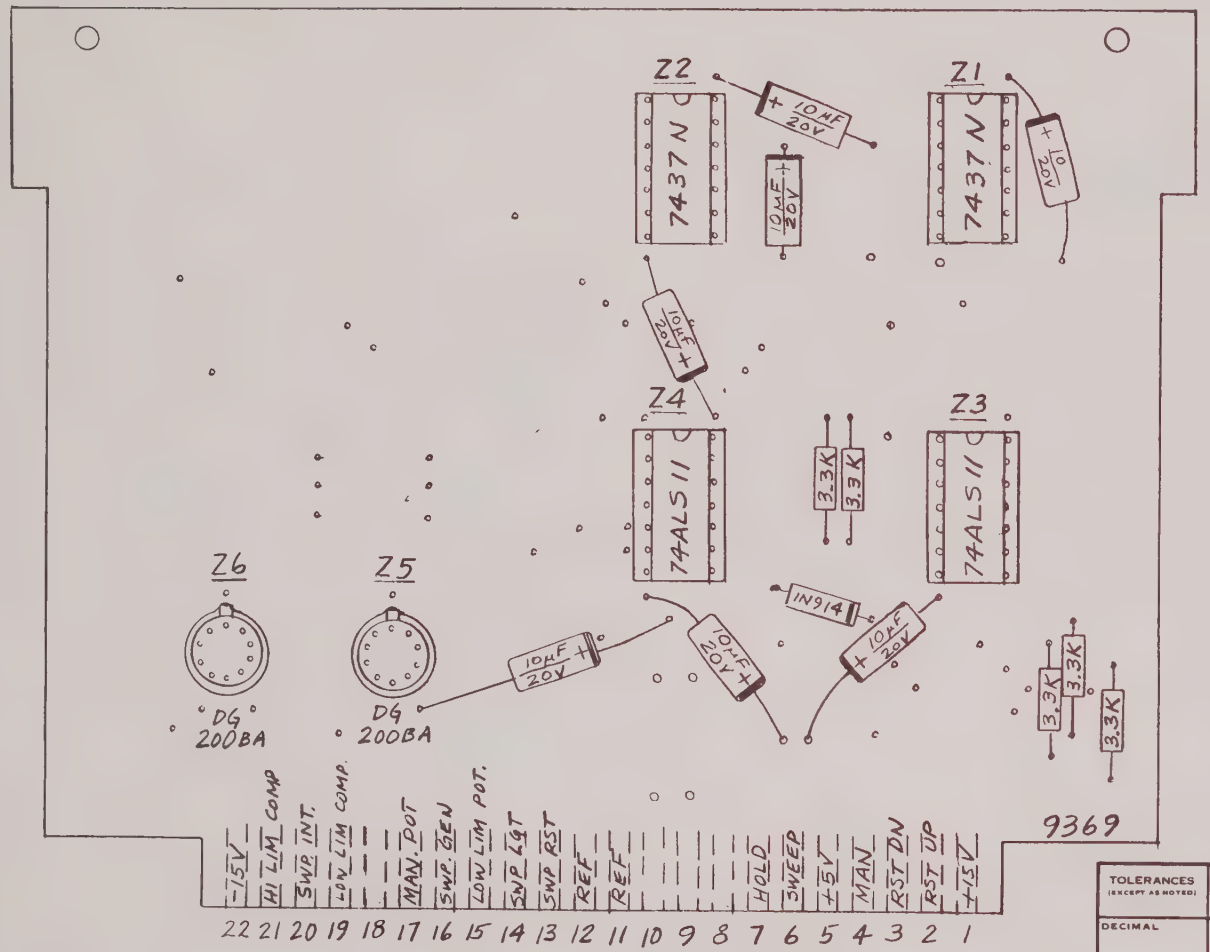
TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ± —	UD 340 UD 345	SCALE —	DRAWN BY TU APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT DECIMAL POINT SELECT		
ANGULAR ±	DATE 5-17-88	DRAWING NUMBER B20222	

FIG. 8.27



DATE	SYM	REVISION RECORD	AUTH	DR	CK
12-86	A	IN100 REM	TU		
		7411 -> 74ALS11	TU		

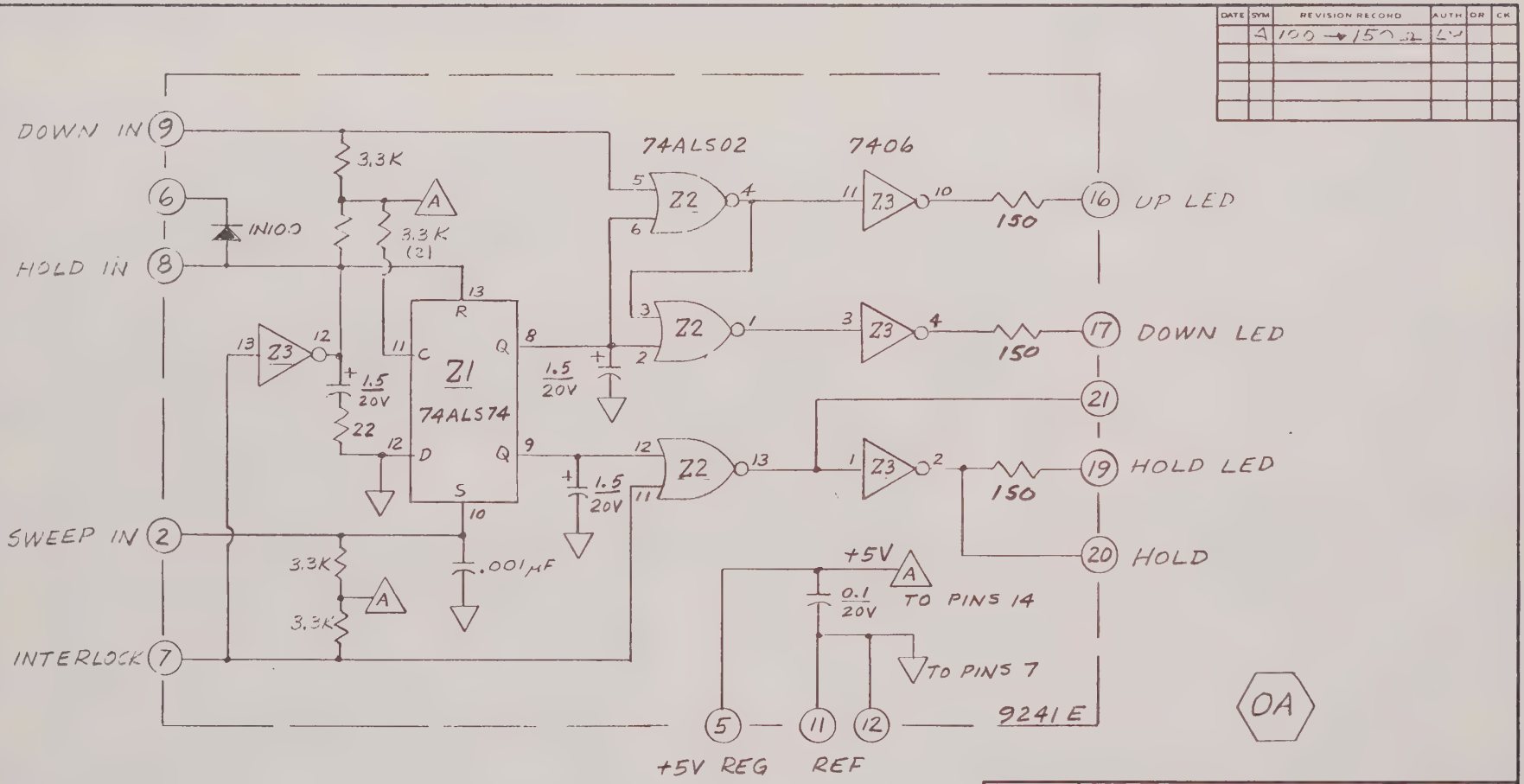
TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD345	SCALE -	DRAWN BY TU; APPROVED BY
FRACTIONAL ±	TITLE: CIRCUIT SCHEMATIC OSC. MODE CONTROL		
ANGULAR ±	DATE 12-18-86	DRAWING NUMBER B 9371 A	



DATE	SYM	REVISION RECORD	AUTH	DR	CK
12-XX	A	IN100 REMVD	TU		
		7411 -> 74ALS11	TU		

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP		
DECIMAL ±	UD345	SCALE	DRAWN BY TU APPROVED BY
FRACTIONAL ±	TITLE OSCILLATOR MODE CONTROL COMPONENT LAYOUT		
ANGULAR ±	DATE 12-18-86	DRAWING NUMBER B9370 A	

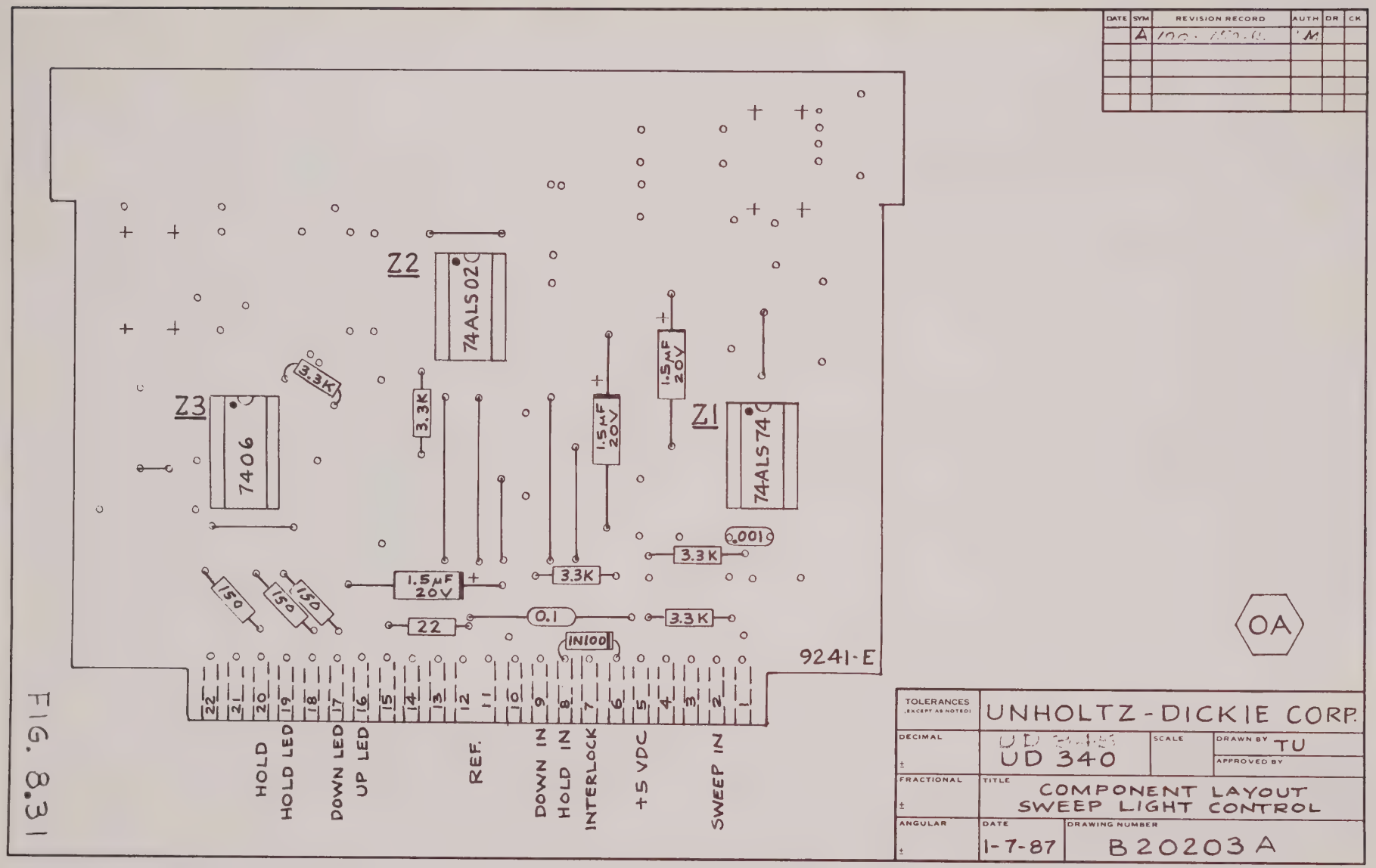
FIG. 8.29



DATE	SYM	REVISION RECORD	AUTH	DR	CK
	A	100 → 150 Ω	LV		

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP		
DECIMAL ±	UD 345 UD 340	SCALE	DRAWN BY LV APPROVED BY
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC SWEEP LIGHT CONTROL		
ANGULAR ±	DATE 12-18-86	DRAWING NUMBER B20202 A	

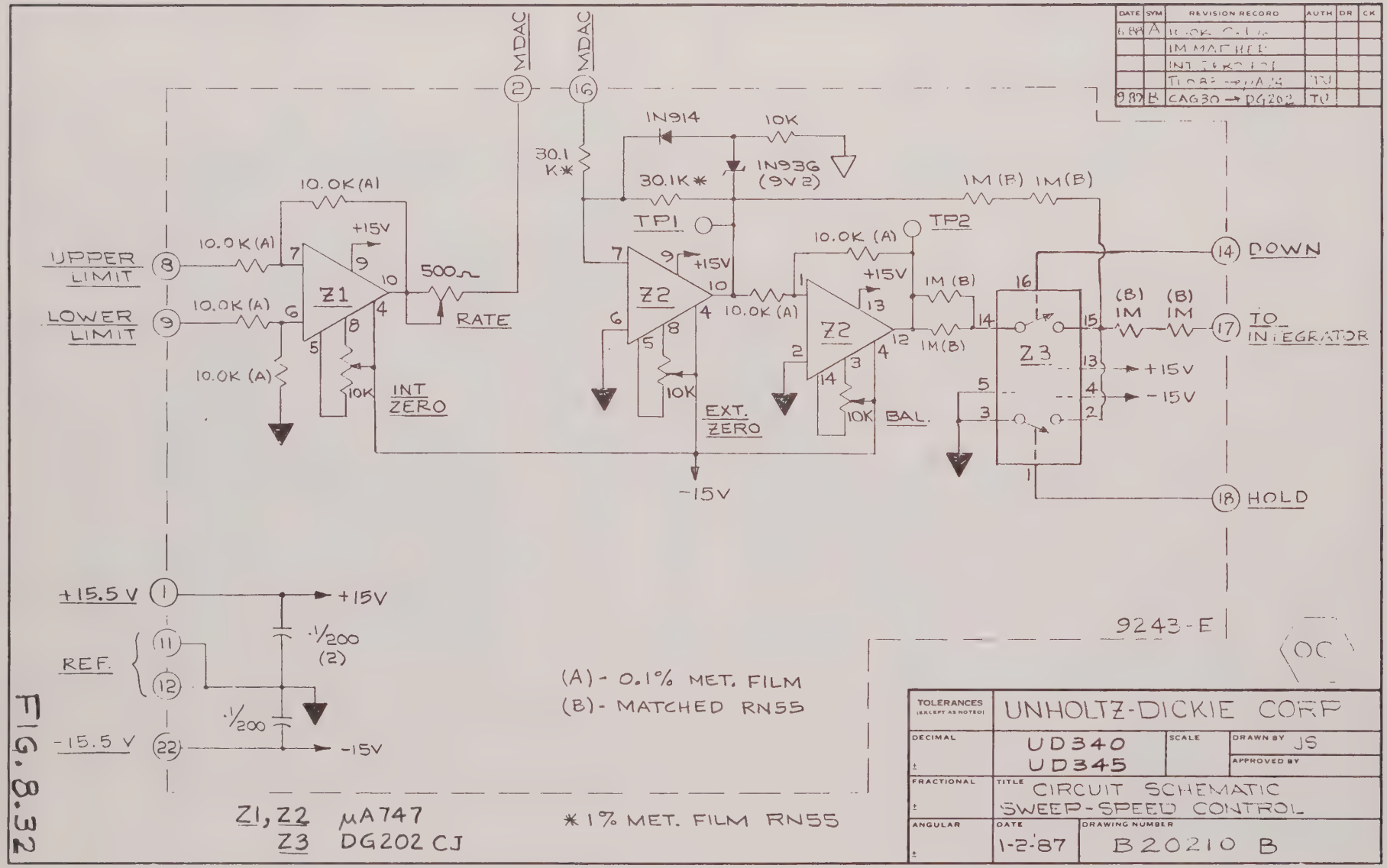
FIG. 8.30



DATE	SYM	REVISION RECORD	AUTH	DR	CK
	A	100 - [illegible]	M		

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD 340	SCALE	DRAWN BY TU
			APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT SWEEP LIGHT CONTROL		
ANGULAR ±	DATE 1-7-87	DRAWING NUMBER B20203 A	

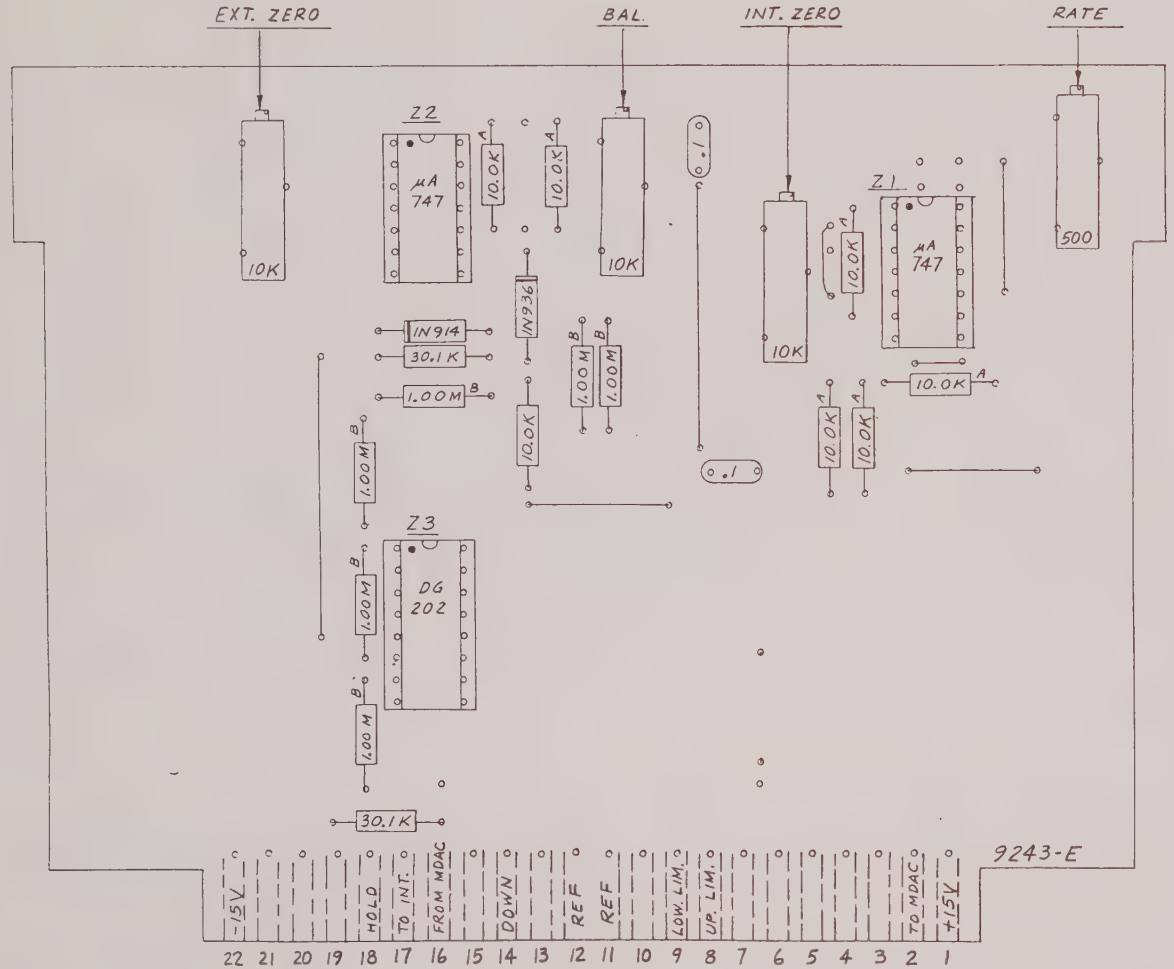
FIG. 8.31



DATE	SYM	REVISION RECORD	AUTH	DR	CK
6.88	A	[illegible]			
		IM MATCHED			
		INT [illegible]			
		[illegible]	TU		
9.88	B	CAG30 → DG202	TU		

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP		
DECIMAL ±	UD340 UD345	SCALE	DRAWN BY JS; APPROVED BY
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC SWEEP-SPEED CONTROL		
ANGULAR ±	DATE 1-2-87	DRAWING NUMBER B20210 B	

FIG. 8.32



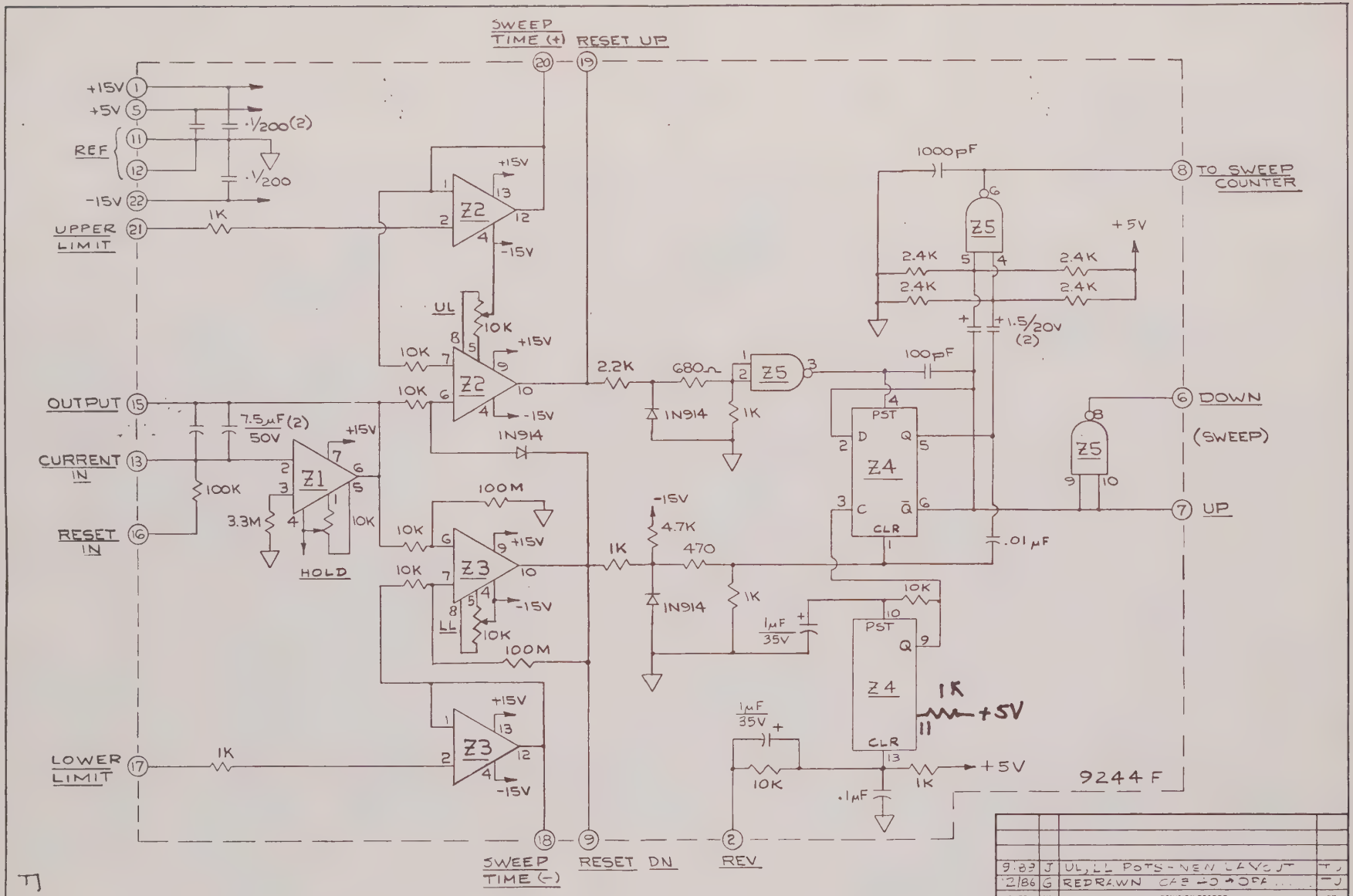
ALL RESISTORS RN55 1%
UNLESS OTHERWISE MARKED
B- MATCHED RN55
C- 0.1% METAL FILM RES

ALL CAPS. IN μF.

OC

UNHOLTZ-DICKIE CORP	
UD345	TJ
COMPONENT LAYOUT SWEEP SPEED CONTROL	
8-27-89	D9298 E

FIG. 8.33



Z1 - OPA 111
Z2, Z3 - µA747
Z4 - 74C74
Z5 - 74ALS00

Z4, Z5 HAVE +5V ON PIN 14, GND ON PIN 7

OD

DATE	BY	REVISION RECORD
9-89	J	UL, LL POTS - NEW LAYOUT
2/86	G	REDRAWN CAD TO DRA...

UNHOLTZ-DICKIE CORP

DECIMAL ±	UD 345 OSP-4	SCALE	DRAWN BY JS
FRACTIONAL ±	TITLE SWEEP GENERATOR BOARD D-OSC		APPROVED BY
ANGULAR ±	DATE 1-3-87	DRAWING NUMBER C9296 - J	

FIG. 5.2

DATE	SYM	REVISION RECORD	AUTH	DR	CK
10/89	K	NEW LAYOUT	TU		
		UL, LL POTS	TU		

ALL RESISTORS 5%

OD

TOLERANCES (EXCEPT AS NOTED)			
DECIMAL ±	UNHOLTZ-DICKIE CORP	SCALE —	DRAWN BY TU
	UD345		APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT SWEEP GENERATOR CARD		
ANGULAR ±	DATE 10-9-89	DRAWING NUMBER B9299 K	

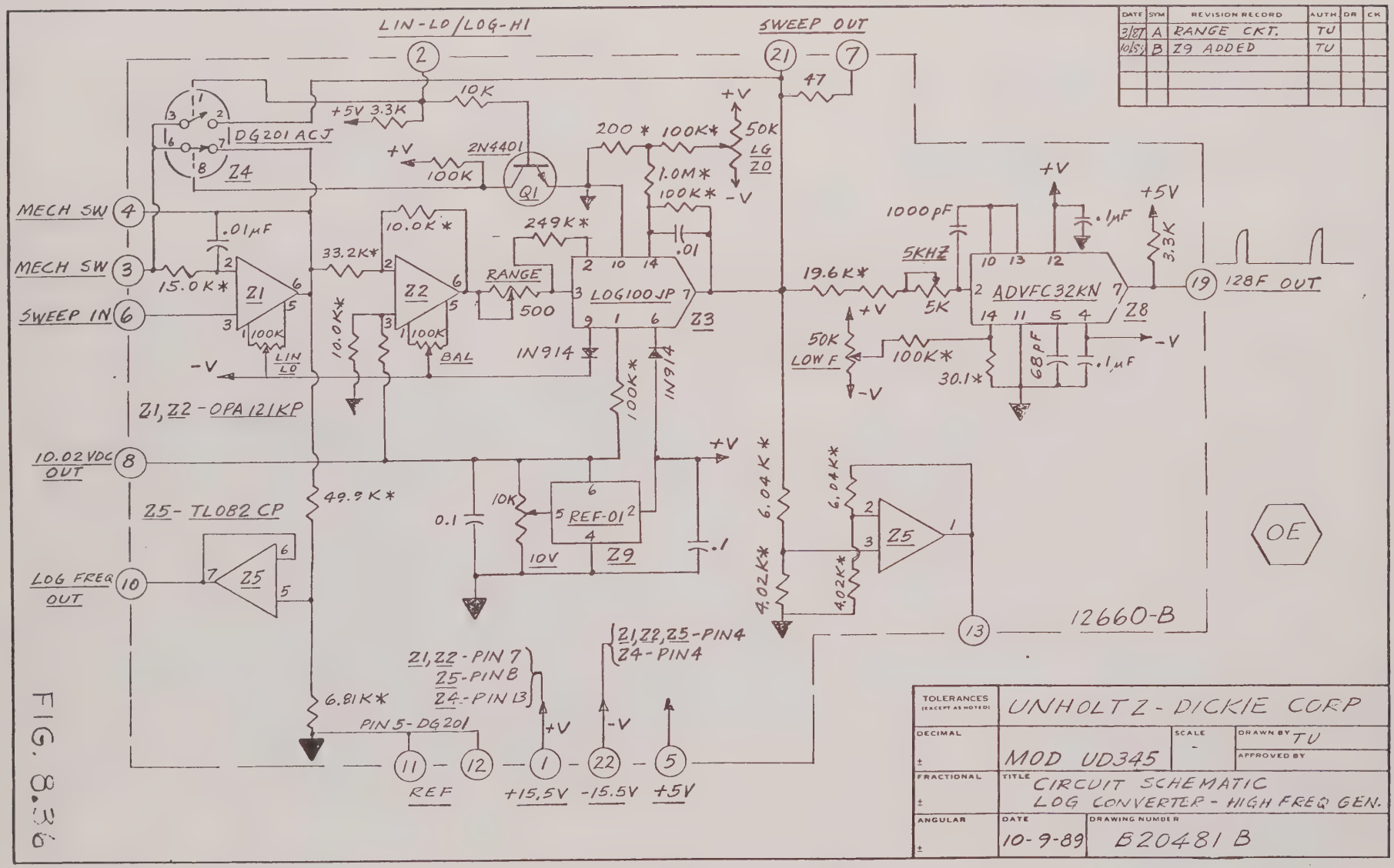
9244 F

REV. SWR. +15V
+5V
SWEEP DOWN
SWEEP UP
TO SWR CTR.
RESET DOWN
REF
REF
CURR. IN
REF
OUTPUT
RESET IN
LOWER LIM.
SWEEP TIME -
RESET UP
SWEEP TIME +
UPPER LIM.
-15V

Z1 OPA 121
Z2 µA747
Z3 µA747
Z4 74ALS74
Z5 74ALS00

UL HOLD
LL

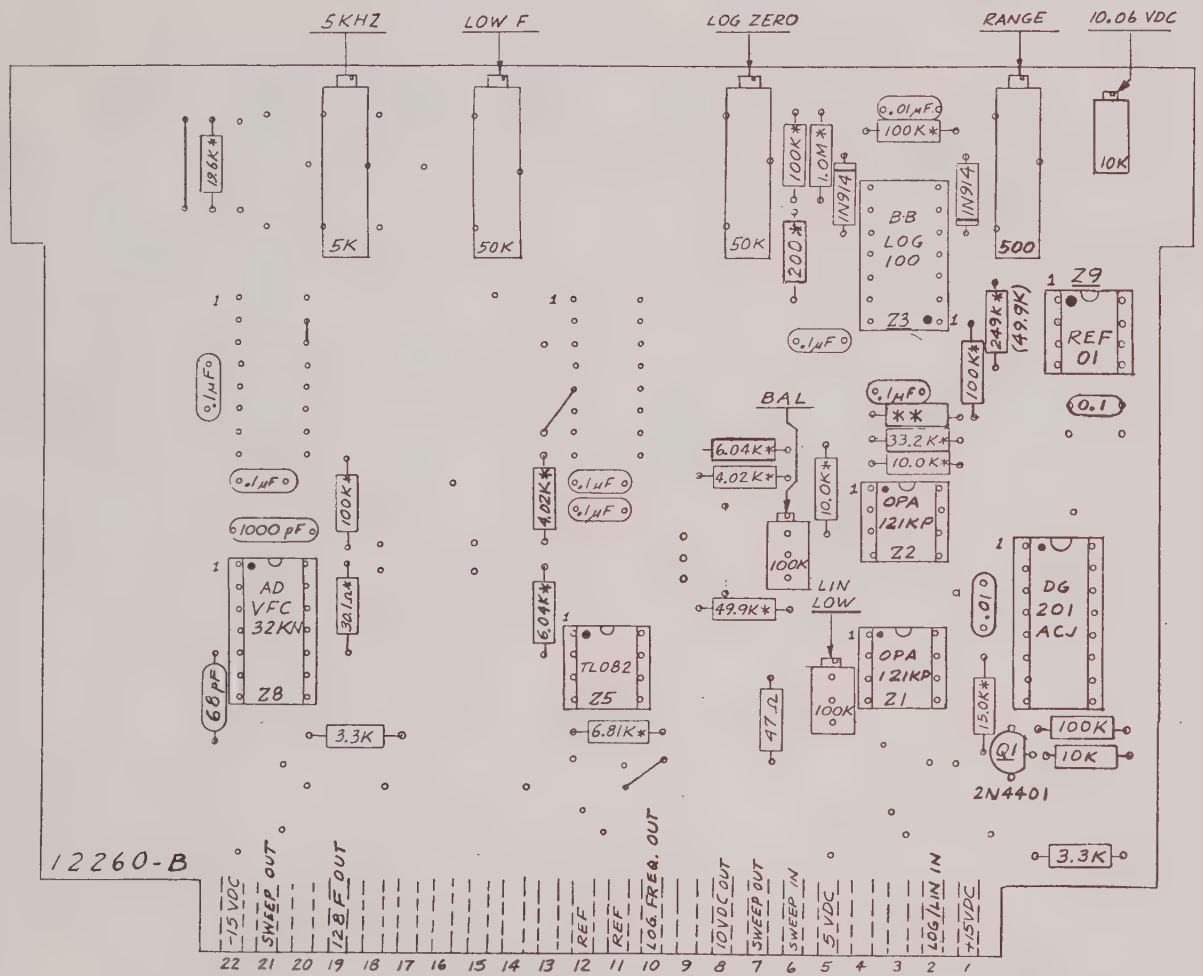
FIG. 8.25



DATE	SYM	REVISION RECORD	AUTH	DR	CK
3/87	A	RANGE CKT.	TU		
10/5/	B	Z9 ADDED	TU		

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ - DICKIE CORP		
DECIMAL ±	MOD UD345	SCALE -	DRAWN BY TU / APPROVED BY
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC LOG CONVERTER - HIGH FREQ GEN.		
ANGULAR ±	DATE 10-9-89	DRAWING NUMBER B20481 B	

FIG. 8.36



3	01	A LAYOUT	TU
10	01	3 29 - LAY 1	TU

	UNHOLTZ-DICKIE CORP	
	UD345	TU
	COMPONENT LAYOUT LOG CONV - M.F. GEN. CARD	
	3/87	B20482 B

FIG. 8.37

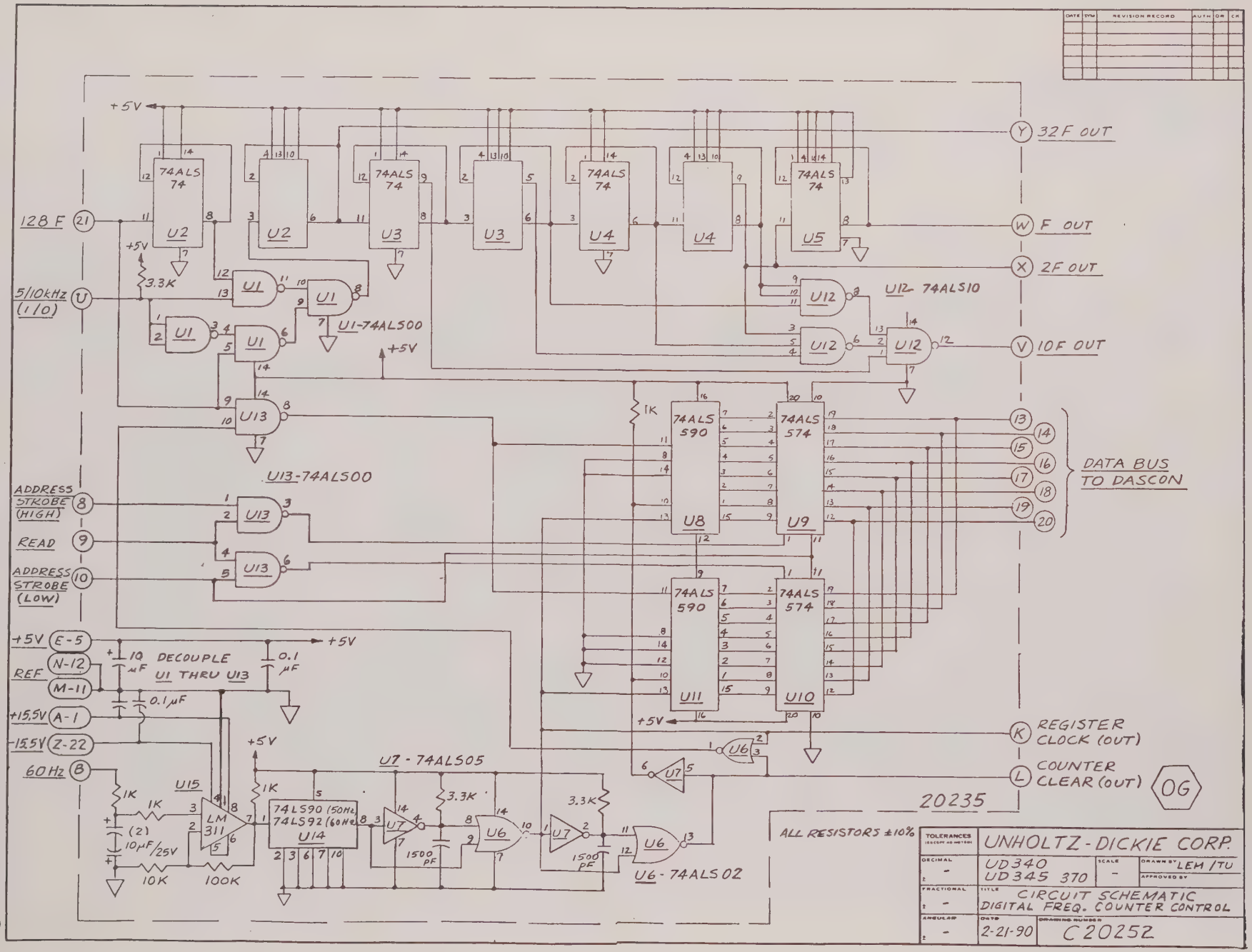
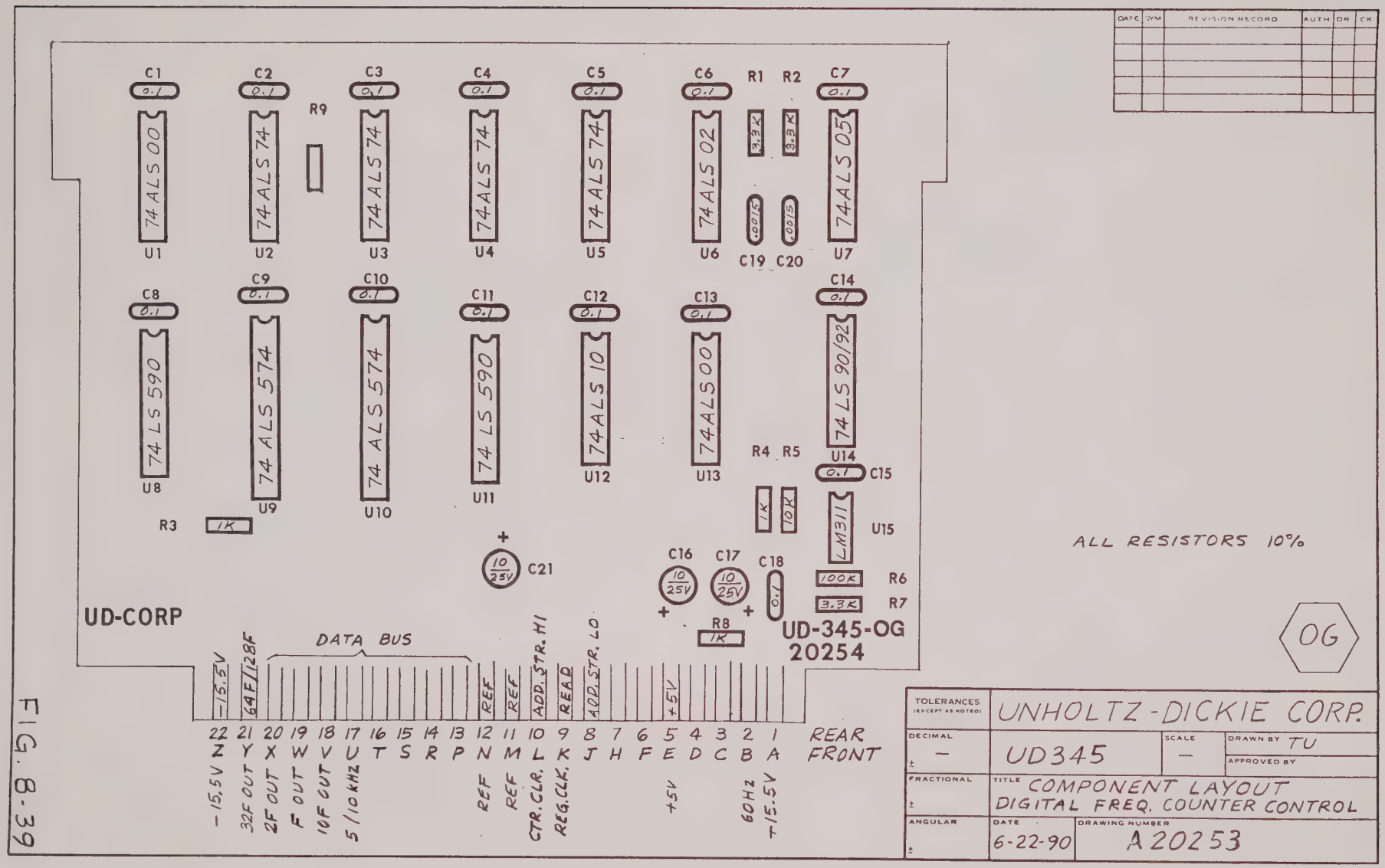

+5V
128 F
21
5/10KHz
(1/0)
U
3.3K
74ALS 74
U2
U3
U4
U5
U1
U1-74ALS00
U12
U12- 74ALS10
Y 32F OUT
W F OUT
X 2F OUT
V 10F OUT
U13
U13-74ALS00
1K
74ALS 590
74ALS 574
U8
U9
U11
U10
DATA BUS TO DASCON
13
14
15
16
17
18
19
20
ADDRESS STROBE (HIGH)
8
READ
9
ADDRESS STROBE (LOW)
10
+5V
E-5
REF
N-12
M-11
+15.5V
A-1
-15.5V
Z-22
60Hz
B
10 μF DECOUPLE U1 THRU U13
0.1 μF
U15
LM 311
(2) 10μF/25V
10K
100K
74LS90 (50Hz)
74LS92 (60Hz)
U14
U7 - 74ALS05
U6
1500 PF
U6 - 74ALS02
K REGISTER CLOCK (OUT)
L COUNTER CLEAR (OUT)
OG
20235
ALL RESISTORS ±10%
UNHOLTZ-DICKIE CORP.
UD340
UD345 370
LEM/TU
CIRCUIT SCHEMATIC
DIGITAL FREQ. COUNTER CONTROL
2-21-90
C20252

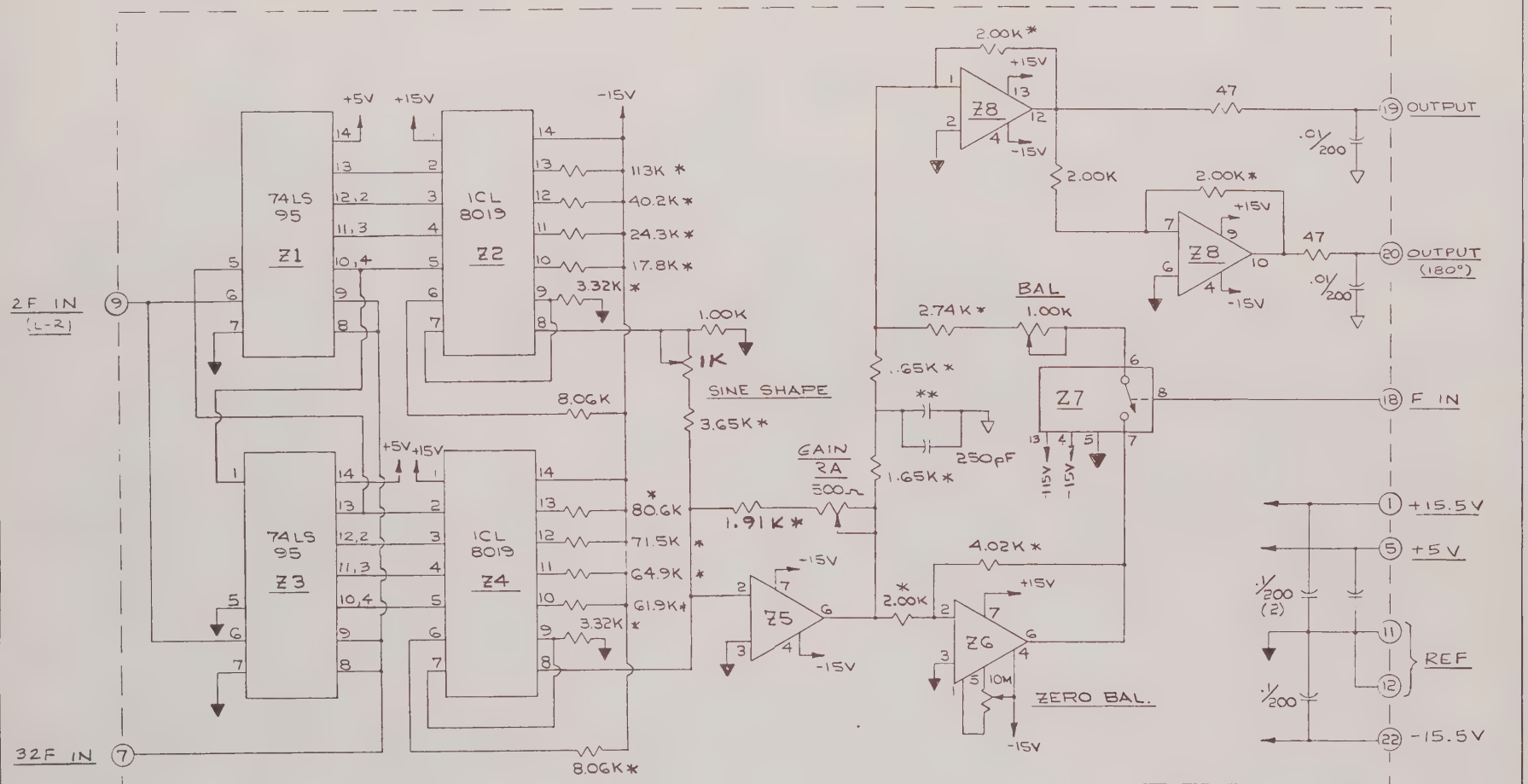
FIG 8.38



DATE	SYM	REVISION RECORD	AUTH	DR	CK

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ± —	UD345	SCALE —	DRAWN BY TU APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT DIGITAL FREQ. COUNTER CONTROL		
ANGULAR ±	DATE 6-22-90	DRAWING NUMBER A 20253	

FIG. 8-39



* 1% METAL FILM - RN55

** FACTORY SELECTED

9249-D

Z5, Z6 - TL081
Z8 - TL083
Z7 - DG202CJ

DATE	SYM	REVISION RECORD	BY
2/89	C	DG530 → DG202CJ	TU
12/86	B	Z8 → TL083	TU

UNHOLTZ-DICKIE CORP.

OSP-4 OSC-1
UD345

SCALE

DRAWN BY JS

APPROVED BY

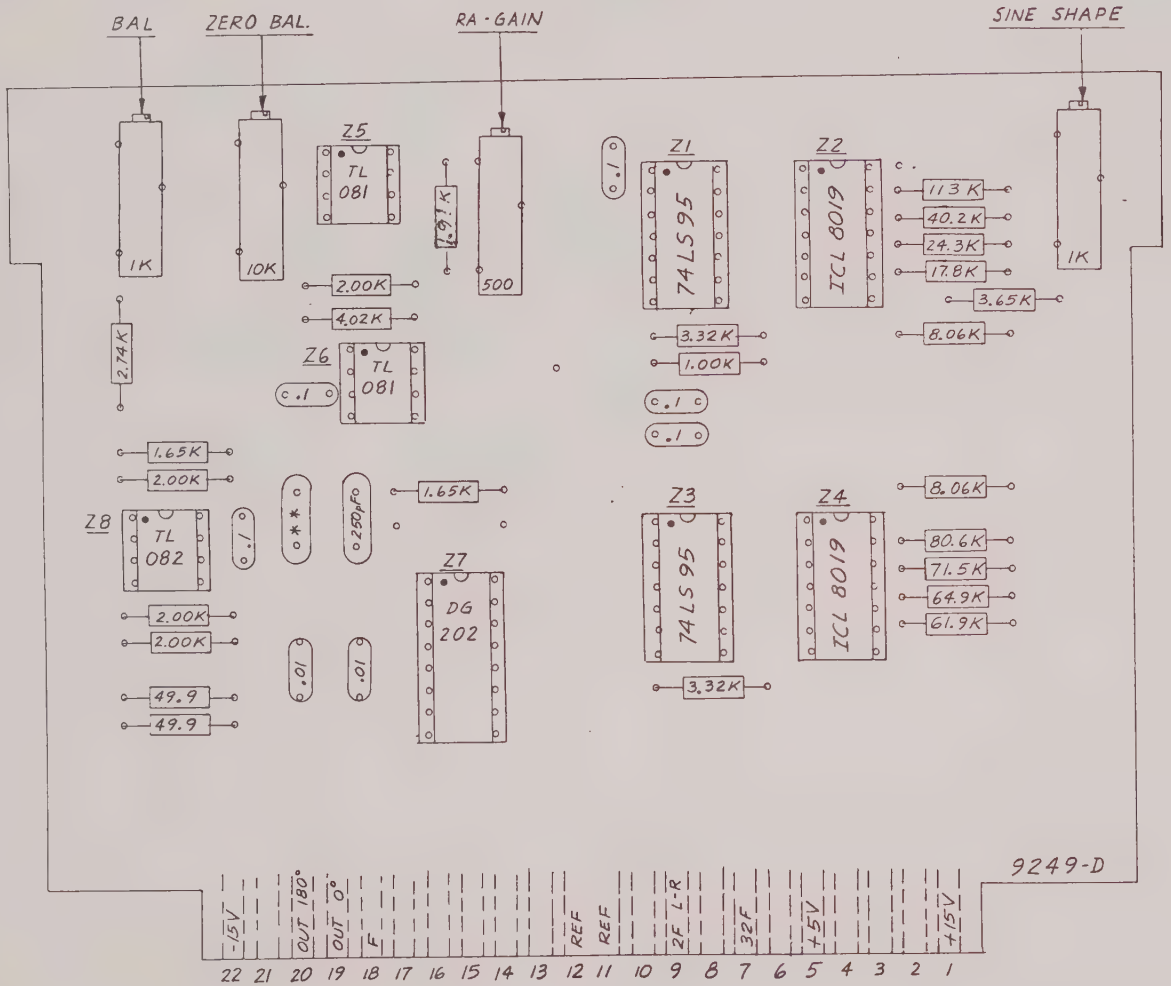
TITLE: SINE GENERATOR BOARD 1-OSC

DATE: 1-2-87

DRAWING NUMBER: C9284-C

OI

FIG. 8.40



ALL RESISTORS RN55 1%

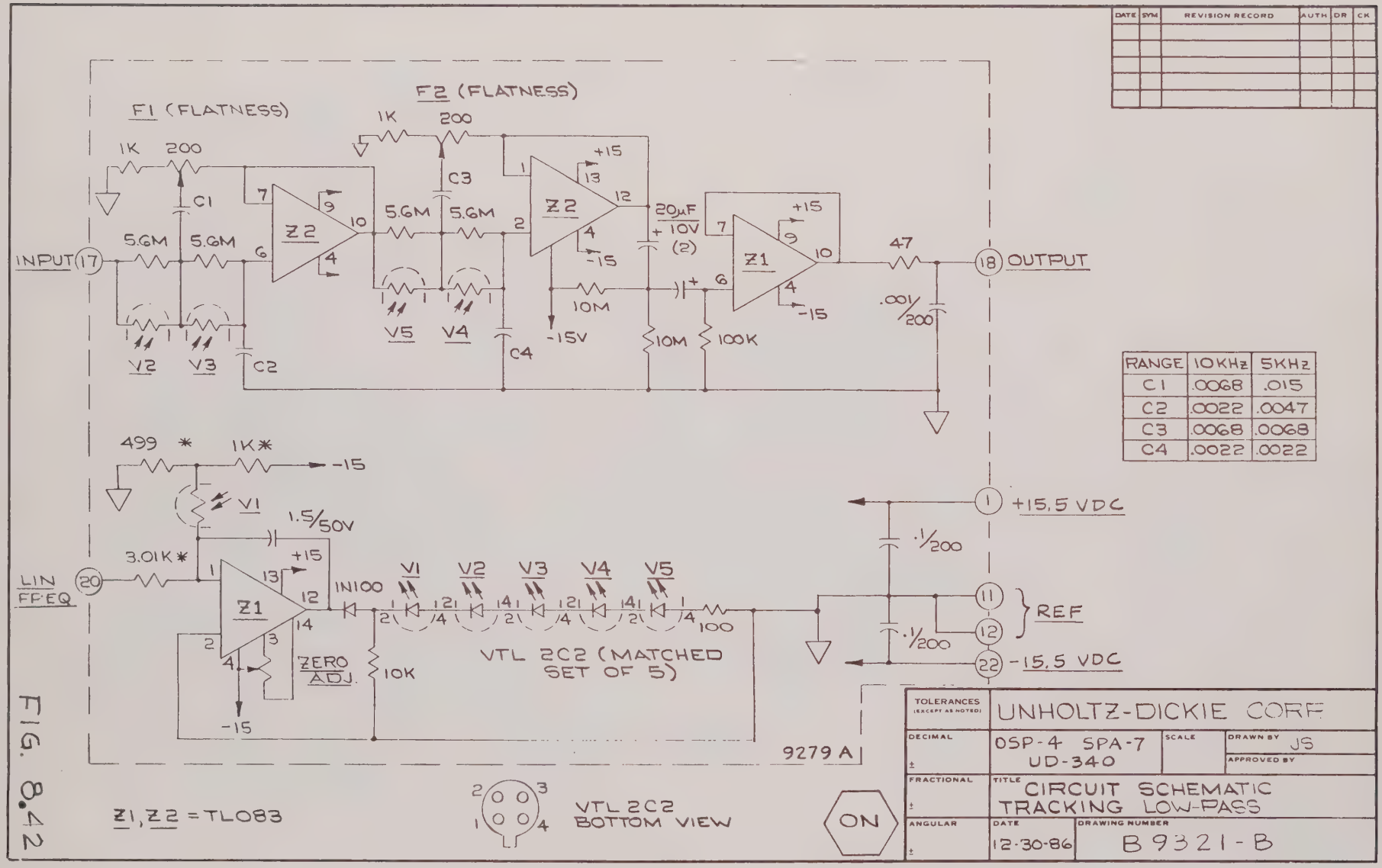
ALL CAPS. IN μF UNLESS OTHERWISE MARKED

**-CAP. VALUE DETERMINED AT CHECKOUT

01

UNHOLTZ-DICKIE COR.
OSC-1 OSP-4
OD-345
COMPONENT LAYOUT
SINE GENERATOR
E-26-89
D 9263 D

FIG 8.41



RANGE	10KHz	5KHz
C1	.0068	.015
C2	.0022	.0047
C3	.0068	.0068
C4	.0022	.0022

DATE	SYM	REVISION RECORD	AUTH	DR	CK

Z1, Z2 = TL083

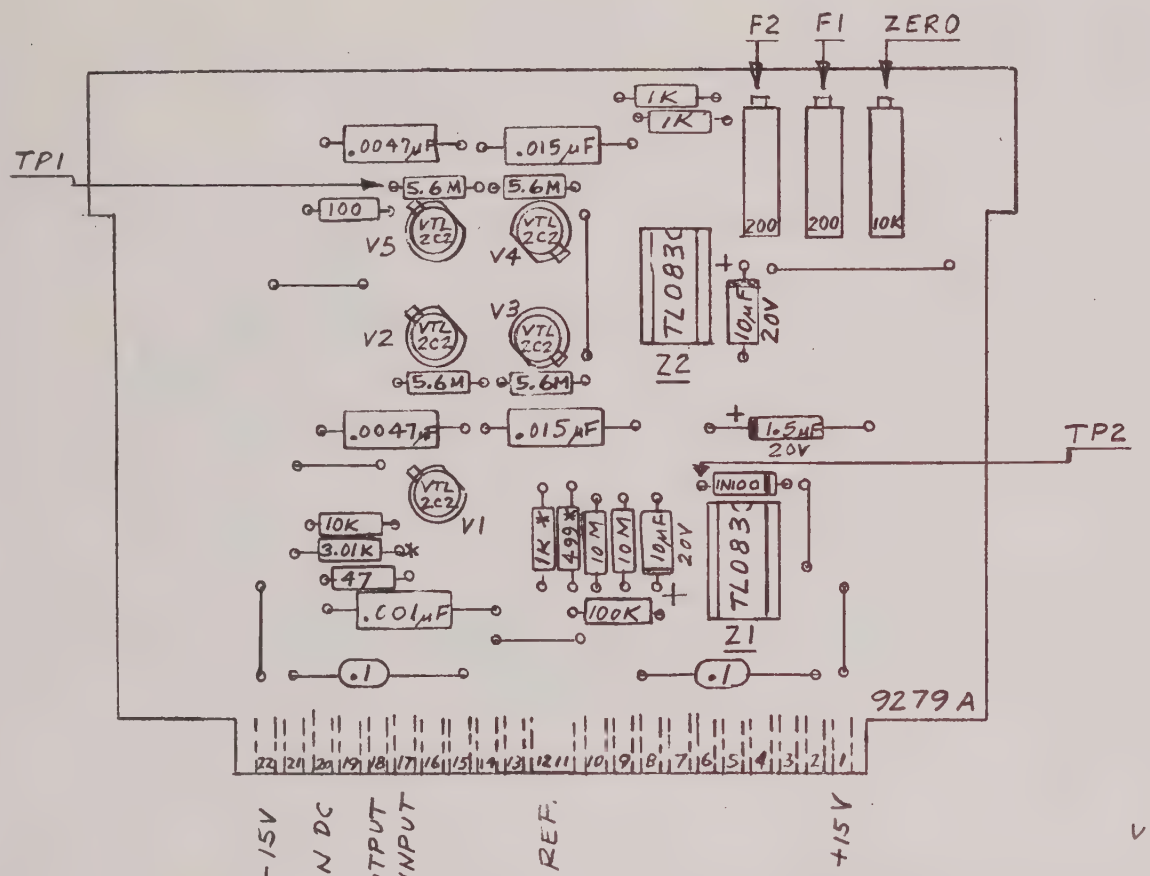
VTL 2C2
BOTTOM VIEW

ON

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP		
DECIMAL ±	OSP-4 SPA-7 UD-340	SCALE	DRAWN BY JS
			APPROVED BY
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC TRACKING LOW-PASS		
ANGULAR ±	DATE 12-30-86	DRAWING NUMBER B 9321-B	

FIG. 8.42

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
5-75	A	BOARD SIZE CHGD	TU		
6-75	B	(4) 2.2M ⇒ 5.6M	TU		
3-78	C	μA747 ⇒ TL082			
12-86	D	PS RES REM'D	TU		



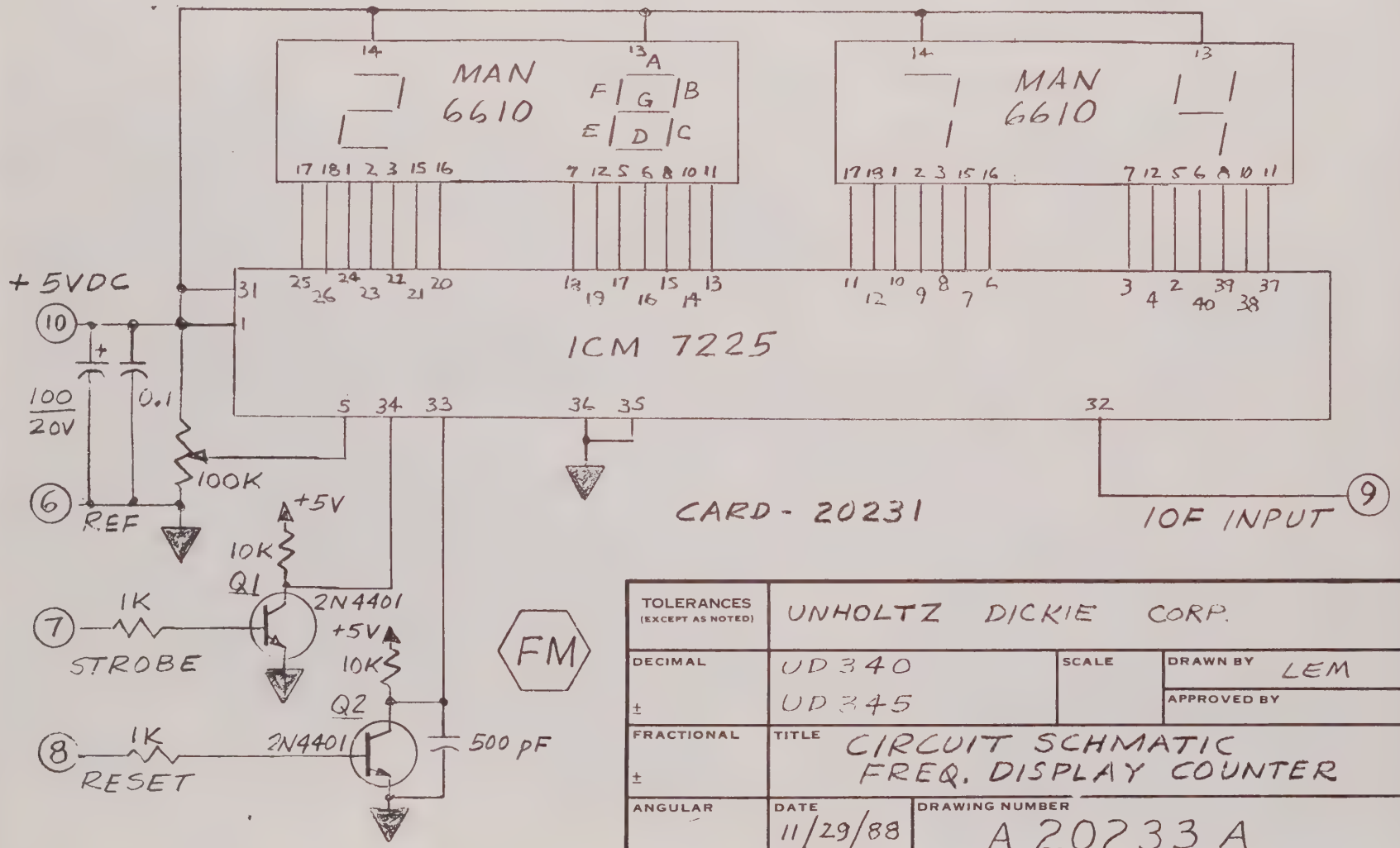
ON

VTL 2C2 - MATCHED SET

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD345 UD340	SCALE	DRAWN BY TU / APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT TRACKING LO-PASS		
ANGULAR ±	DATE 12-18-86	DRAWING NUMBER A9322 D	

FIG. 8.43

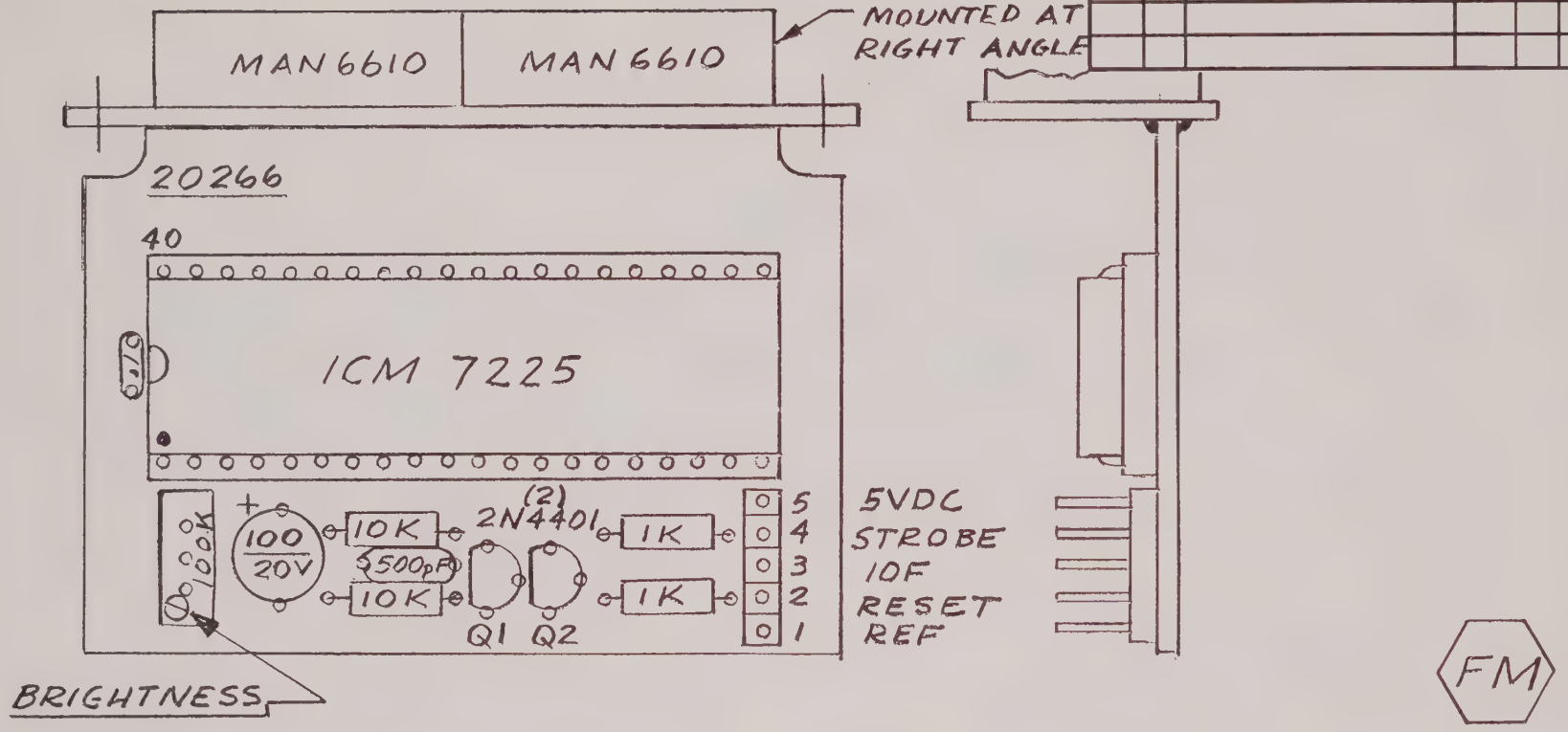
DATE	SYM	REVISION RECORD	AUTH	DR.	CK.
7/89	A	500 pF ADDED	TU		



TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ DICKIE CORP.		
DECIMAL ±	UD 340 UD 345	SCALE	DRAWN BY LEM APPROVED BY
FRACTIONAL ±	TITLE CIRCUIT SCHMATIC FREQ. DISPLAY COUNTER		
ANGULAR ±	DATE 11/29/88	DRAWING NUMBER A 20233 A	

FIG. 8.44

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.



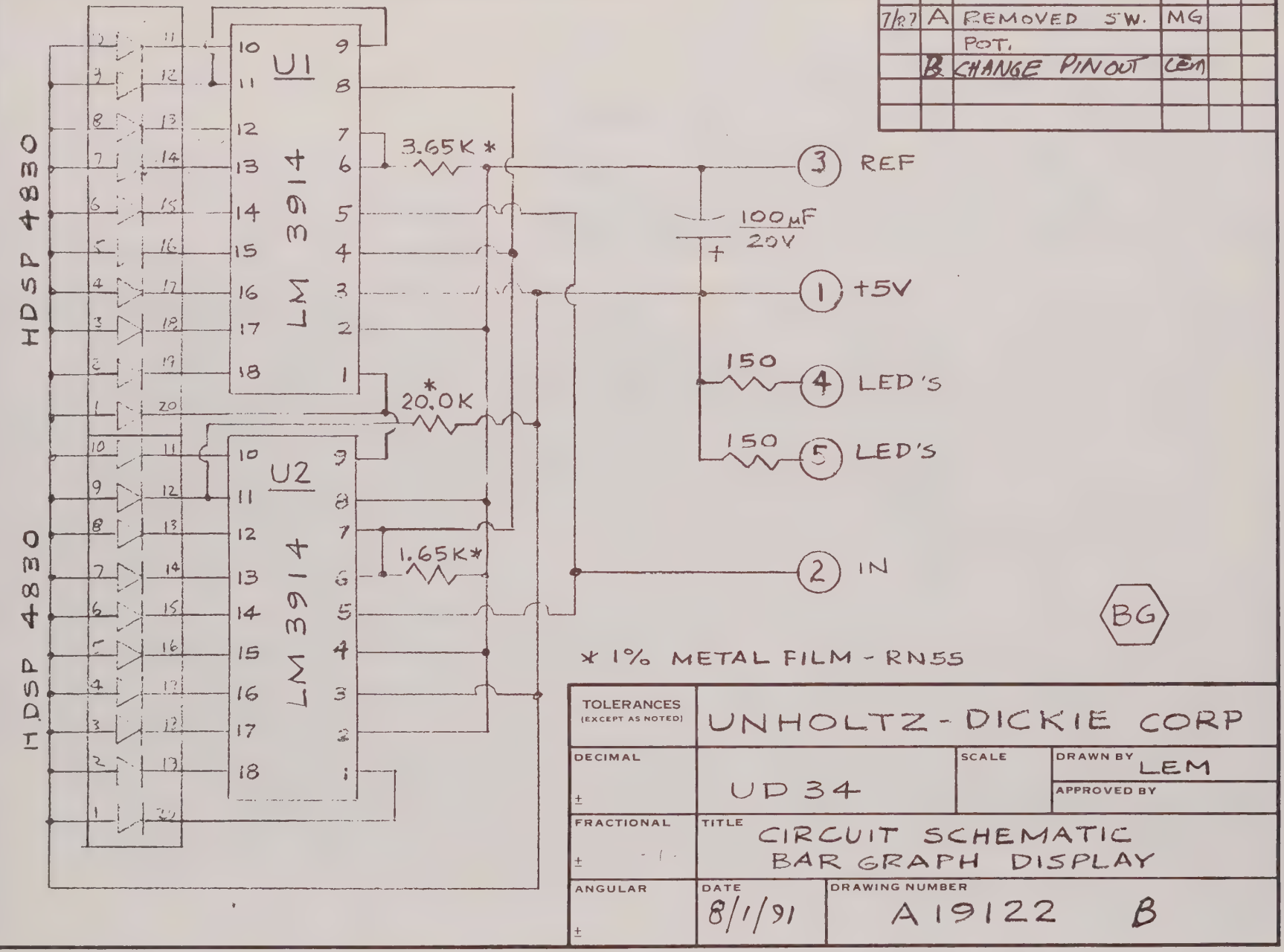
FM

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD 345 UD 370	SCALE	DRAWN BY TU APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT FREQUENCY DISPLAY ASSY.		
ANGULAR ±	DATE 10/8/90	DRAWING NUMBER A 20267	

FIG 8.45

K·E ALBANENE ® 10 5465
ENGINEERS' STANDARD FORM

MADE IN U.S.A.

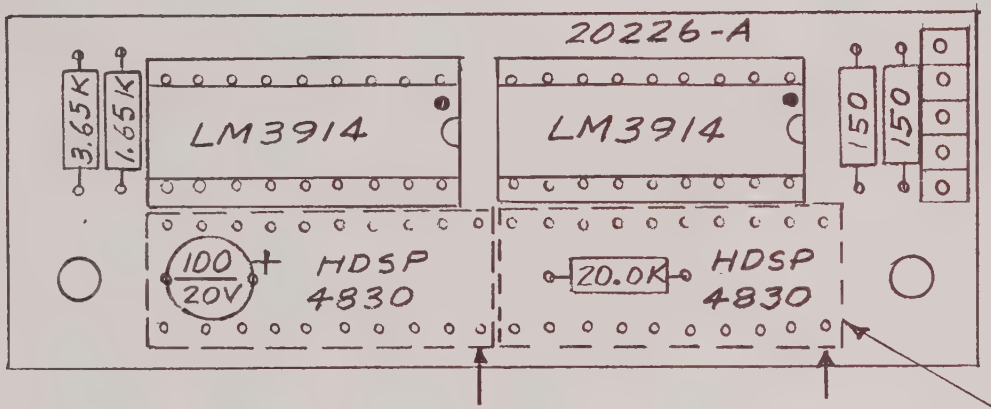


DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
7/27	A	REMOVED SW.	MG		
		POT.			
	B	CHANGE PINOUT	LEM		

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP		
DECIMAL ±	UD 34	SCALE	DRAWN BY LEM APPROVED BY
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC BAR GRAPH DISPLAY		
ANGULAR ±	DATE 8/1/91	DRAWING NUMBER A19122 B	

FIG. 8.46

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.



ALL RESISTORS RN55 1%

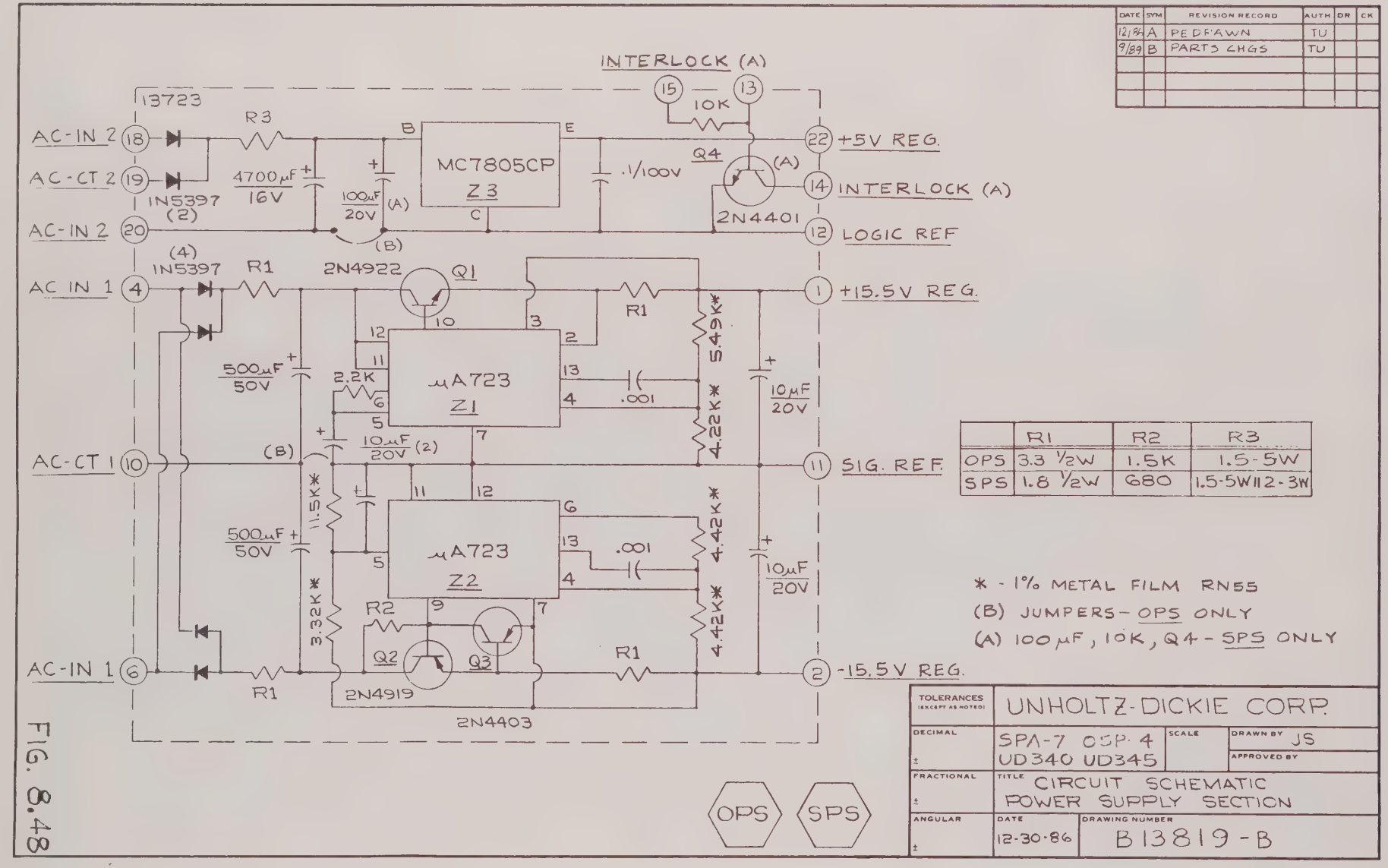
BG

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ - DICKIE CORP.		
DECIMAL ±	UD345 UD370	SCALE	DRAWN BY TU APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT BAR GRAPH DISPLAY		
ANGULAR ±	DATE 4-26-90	DRAWING NUMBER A 20271	

FIG 8.47

K·E ALBANENE ® 10 5465
ENGINEERS' STANDARD FORM

MADE IN U.S.A.



DATE	SYM	REVISION RECORD	AUTH	DR	CK
12/84	A	PEDRAWN	TU		
9/89	B	PARTS CHGS	TU		

	R1	R2	R3
OPS	3.3 ½W	1.5K	1.5-5W
SPS	1.8 ½W	680	1.5-5W|2-3W

* - 1% METAL FILM RN55

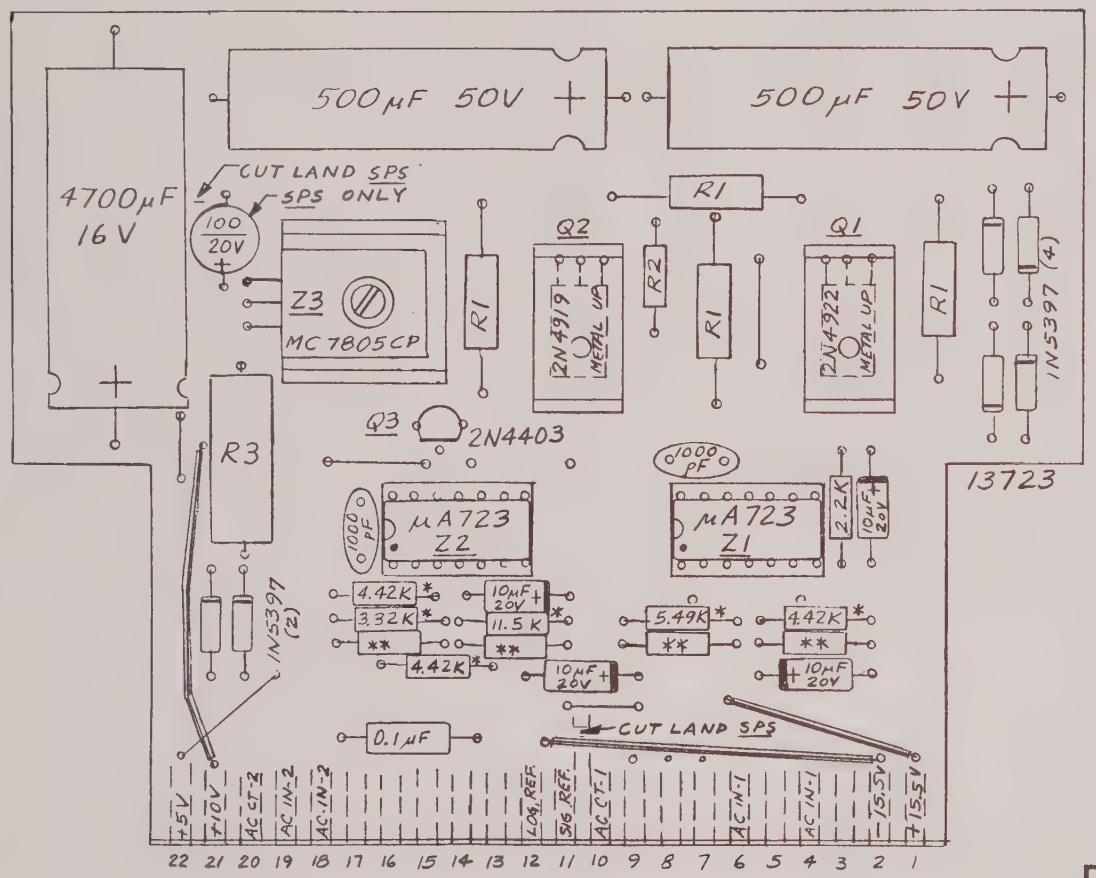
(B) JUMPERS - OPS ONLY

(A) 100µF, 10K, Q4 - SPS ONLY

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.
DECIMAL ±	SPA-7 OSP-4 UD340 UD345
SCALE	
DRAWN BY	JS
APPROVED BY	
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC POWER SUPPLY SECTION
ANGULAR ±	DATE 12-30-86
DRAWING NUMBER	B13819-B

FIG. 8.48

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
11/86	C	RESISTOR CHGS.	TU		
9/89	D	RESISTOR CHGS	TU		



	R1	R2	R3
OPS	3.3 ½W	1.5K	1.5-5W
SPS	1.8 ½W	680	1.5-5W‖2-3W

OPS SPS

* - 1% METAL FILM - RN55

** - FACTORY SELECT

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD340 UD345 SPA-7 OSP-4	SCALE	DRAWN BY TU / APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT POWER SUPPLY CARD		
ANGULAR ±	DATE 12-19-86	DRAWING NUMBER B13724-D	

FIG. 8.49

9. RESONANT DWELL TESTING

9.1 General Description

The Resonant Dwell Option requires the Model UD345 Sine Control as well as additional host software to provide resonant dwell control. The Model UD345 contains the additional hardware to provide digitally-directed phase control of the selected control signal and provides the other sine control functions of the Model UD340. User-friendly menus together with simple function key and other keyboard commands allow the user to perform completely automatic resonant dwell tests, and display/store data automatically.

The Model UD345 controls the operating frequency to maintain a preset relationship between the phase of the reference signal and the specimen response signal. If the specimen resonance frequency (and phase) shifts, the test frequency automatically changes to maintain the preset phase difference. The specimen response signal is normally obtained from an accelerometer attached to the specimen, but it may be obtained from other transducers, including non-contact types.

The reference signal is a digitally phase-shifted version of the oscillator signal. The phase of the reference signal is automatically selected to provide 90° phase difference between the reference and response signals at the desired frequency. The gain and feedback sense of the phase control loop are automatically selected to provide optimum time response of the phase control loop for a wide range of Q.

9.2 Test Setup Formats

Two formats for resonant dwell tests are provided. In the first type the control frequency is specified in the TEST SETUP Menu along with upper and lower limit frequencies which provide automatic test shutdown if the control frequency shifts to either value during the test. Amplitude control may also be specified for the response signal providing phase control, or amplitude control may be specified for another response channel in the vibration test system. Abort and alarm limits are also specified by the operator for the amplitude control signal.

The second format for resonant dwell testing provides a preliminary sweep to identify the resonance frequency in question. The preliminary sweep identifies a frequency at which a maximum (or minimum) response occurs, and also estimates the Q from the half-power frequencies. The identified resonance frequency is used to automatically start the resonant dwell test after the single sweep is terminated. Should more than one peak (minimum) response be identified, these frequencies are listed by the printer along with the estimated Q values, and the test is automatically terminated. The operator can then select a meaningful resonant dwell test frequency and provide a separate TEST SETUP.

When the dwell test is initiated by simple key strokes, or automatically after the sweep search, amplitude is ramped to -20 dB below the full test level at the desired frequency and the reference phase is automaticallly selected as well as the gain and feedback sense of the phase control loop. After this short measurement and adjustment procedure, the phase control loop is closed and the test is begun.

9.3 Summary of Testing Features

AUTO and MANUAL modes of testing are provided. If the AUTO mode of testing is selected, control amplitudes and associated time durations are followed from the LEVEL SCHEDULE table in the TEST SETUP Menu. The phase control loop provides appropriate shifts of the resonance frequency due to fatigue effects, as well as nonlinear effects from amplitude changes. Time duration at each test level may be specified directly in hr: min: sec or in terms of cycles at the operating frequency.

At any time the MANUAL mode of testing may be selected by keyboard command. In this mode the level of the amplitude control may be increased or decreased .1 dB at a time by means of the up and down arrow keys between -20 dB and 0 dB (full test level). Simultaneous application of the SHIFT key and the arrow key causes the amplitude to change by 1.0 dB. By means of the right and left arrow keys, the phase of the reference signal may be changed in 2.8° increments in order to fine-tune the resonance frequency.

During the MANUAL mode of operation, measurement of the Q or quality factor of the resonance may be initiated by a single key stroke. The reference phase is automatically shifted 22.5° to each side of the operating value and the resulting shifts of frequency are used for the calculation of Q.

Also, an additional resonance search may be initiated in the MANUAL mode by a key stroke. The routine causes the reference phase to be shifted in the direction of larger phase slope (as a function of frequency). When further increases cannot be detected, the routine terminates.

In the following sections, the results from an actual vibration test are illustrated to demonstrate the operating techniques.

9.4 Resonant Dwell Test Setup - Sweep Search

The test setup format to be illustrated in this section is the second one described in Section 9.2: the preliminary sweep, followed by an automatic resonant dwell test. The actual test included a UD Model 5 Shaker exciting a printed circuit board assembly. For the sweep, constant acceleration was maintained at the point of attachment to the shaker table and the acceleration was monitored on top of one of the integrated circuits mounted on the p.c. card.

The first two pages of the SINE TEST SETUP are shown in Figs. 9-1 and 9-2. The procedure for creating a SINE TEST SETUP is described in Chapter 3. Notice that the parameter entries are identical to those for the typical sine sweep test.

If an entry of 4=RESONANT DWELL were made to the TEST TYPE query, the SETUP Menu changes and only entries related to a resonant dwell test may be made. This alternative is described in Section 9.5.

Channel 1 is connected to the acceleration signal for the shaker table and Channel 2, to the acceleration signal for the top of the integrated circuit. The sweep range is limited to a small bandwidth (600 to 800 Hz) so as to monitor only one resonance. If more than one resonance is identified, then the test will terminate after the sweep.

The sweep rate must be slow enough so that the frequency does not sweep through the resonance too rapidly, and cause an amplitude beating effect after sweeping through the resonance. For Q's higher than 100, sweep times of several minutes may be necessary.

The entry (Y) to the query

RESONANT DWELL AT END OF SWEEP

causes a third page for the SINE TEST SETUP to appear, which is shown in Fig. 9-3. The entries on this page give details for the automatic resonant dwell test which follows the sweep search. Notice that the amplitude and phase control channels are identical and that the full test level is approximately the level expected on the sweep search.

The two HELP pages which explain the entries in Fig. 9-3 are shown in Figs. 9-4 and 9-5. These are obtained by pressing (Shift, ?) and (Pg Dn).

Upon returning to the Menu for the SINE TEST SETUP, the fourth and fifth pages are shown in Figs. 9-6 and 9-7. Fig. 9-6 shows the entries for the sine sweep. Note the rather low entry for the control (Channel 1) acceleration, since a rather large magnification is expected at the resonance for Channel 2.

Fig. 9-7 specifies the LEVEL SCHEDULE for the AUTO mode of the resonance dwell test. This is similar in form to that for random vibration testing. HELP pages are available for explaining the entries. The type of DURATION entries are determined by the entry for RESONANT DWELL DURATION TYPE shown in Fig. 9-3, so that the duration of each test level may alternatively be expressed in cycles, kilocycles or megacycles of strain at the operating frequency.

The last page of the TEST SETUP Menu, which is not shown here, is a graph of the sweep search portion of the test, showing the control level and the alarm and abort levels.

Fig.9-1

```
                    SINE TEST SETUP

SETUP ID : RESDWELL
                                        Last Changed : 08/09/89 13:45:53
TEST DESCRIPTION : DEMO OF RESONANCE SEARCH FOLLOWED BY AUTOMATIC RES. DWELL

TEST TYPE : ..................>1
    <1=LOG SWEEP, 2=LINEAR SWEEP, 3=DISCRETE FREQUENCIES, 4=RESONANT DWELL>

MAXIMUM SERVO SPEED : .........>2
    <1=100dB/sec, 2=300dB/sec, 3=1k dB/sec, 4=3k dB/sec>

INPUT SENSITIVITY : ...........>1
    <1=10mV/g, 2=100mV/g, 3=1000mV/g>

CONTROL CHANNEL INPUT SEQUENCE.>1, , , , , , ,
    <N=CHN FOR N=1-8>


ANALYSIS CHANNEL SAMPLING SEQ..>2, , , , , , ,
    <N=CHN FOR N=1-8, or 0>

    ->              ?-Help
```

Fig.9-2

```
       SETUP ID : RESDWELL    SINE TEST SETUP

LOWER FREQUENCY LIMIT (Hz) : ..>600

UPPER FREQUENCY LIMIT (Hz) : ..>800

TEST LIMIT TYPE : .............>1
    <1=NUMBER OF SWEEPS, 2=TOTAL TIME>

NUMBER OF SWEEPS : ............>1
    <0=CONTINUOUS, 1 to 9999>

SWEEP TIME (Min) : ............>1
SWEEP RATE (Oct/min) : ........>0.42

STARTING SWEEP DIRECTION : ....>1
    <1=UP, 2=DOWN>

STARTING FREQUENCY (Hz) : .....>600

RESONANT DWELL AT END OF SWEEPS>Y
    <Y=YES, N=NO>

   ->           ?-Help
```

Fig.9-3

```
       SETUP ID : RESDWELL    SINE TEST SETUP

LOWER FREQ LIMIT <-X> : .......>25
UPPER FREQ LIMIT <+X> : .......>25

RATIO : ......................>10

AUTOMATIC RESONANT SEARCH : ...>N
    <Y=YES, N=NO>

AMPLITUDE (LEVEL) CONTROL CHAN:>2

PHASE CONTROL CHANNEL <1-8> ...>2

FULL TEST LEVEL (0 dB) (g) : ..>10

RESONANT DWELL DURATION TYPE : >1
    <1=TIME LIMIT, 2=NUMBER OF CYCLES, 3=KILOCYCLES, 4=MEGACYCLES>

DISPLAY DATA AUTOMATICALLY? : .>2
    <1=END OF TEST, 2=END OF EACH LEVEL, 3=PERIODICALLY, 4=NO>

   ->           ?-Help
```

Fig.9-4

TEST SET UP Line Item Descriptions

FREQUENCY LIMITS - For a resonant dwell frequency determined by a single sweep, enter the maximum acceptable changes in percent. When the resonant dwell test frequency is specified in the menu, enter the frequency limits in Hz. If the test frequency changes to either limit, the test automatically aborts.

TEST FREQ - Enter the frequency at which the resonance dwell test will start.
OR
RATIO - Enter the minimum ratio between the analysis channel and control channel responses that will be recognized as a resonance.

AUTOMATIC RESONANT SEARCH - A yes response institutes an automatic search routine following ramping that sets the phase reference at a point near maximum phase slope.

AMPLITUDE (LEVEL) CONTROL CHANNEL - Enter the number of the channel for which acceleration will be kept constant during resonant dwell. The control channel signal/hardware is always used for amplitude control.

PgDn - to continue Esc - back to menu

Fig.9-5

TEST SET UP Line Item Descriptions

PHASE CONTROL CHANNEL - Enter the number of the channel for which the resonance frequency will be tracked during the test. If the same channel is used for amplitude control, the control channel supplies the signal for both loops, and the analysis channel may be used to monitor any other channel during the test. However, if the phase control channel is different from the amplitude control channel, the analysis signal/ hardware is used for phase control and cannot be switched during the test.

FULL TEST LEVEL (0 dB) - Enter the full test level for the amplitude control channel.

RESONANT DWELL DURATION TYPE - Choose the numerical form for expressing the duration of the resonant dwell test segments.

DISPLAY DATA AUTOMATICALLY - A large area of the video display is devoted to display of numerical data from the resonance dwell test. The sixteen most recent data displays are always visible. Enter the desired mode of data display. If (3=PERIODICALLY) is entered, an additional request for the appropriate time interval is added to the menu.

PgUp - back up one screen PgDn - forward one screen Esc - back to menu

Fig.9-6

SETUP ID : RESDWELL PROGRAM TABLE

SEGMENT NO.	FREQUENCY (Hz)	FUNCTION (D,A,V,S)	LEVEL (mil pk-pk)	LEVEL (g-pk)	LEVEL (in/s-pk)	ALARM (+%)	ALARM (-%)	ABORT (+%)	ABORT (-%)
1	600	A	0	0.3	0.03	32	24	40	30
2	800		0	0.3	0.02	32	24	40	30

Fig.9-7

SETUP ID : RESDWELL RESONANT DWELL - LEVEL SCHEDULE
0 dB = 10.00 g

STEP NO.	LEVEL (-dB REL TO REF)	DURATION Hours	Min	Sec	ALARM (+%)	ALARM (-%)	ABORT (+%)	ABORT (-%)	PERFORM STEPS From	To	Times
1	0			15	40	30	60	50			
2	10			15	40	30	60	50			
3	20			15	40	30	60	50			
4	10			15	40	30	60	50			
5	0			15	40	30	60	50			
6	20			15	40	30	60	50	1	6	5

9.5 Resonant Dwell Test Setup - No Search

Figure 9-8 shows the menu entries for a resonant dwell SINE TEST SETUP that has no initial sweep search. After the entry (4) is confirmed for TEST TYPE, most of the queries in Figs. 9-1 and 9-2 do not appear, and only those similar to those in Fig. 9-3 appear on the second page. It is naturally assumed that the resonance in question has been identified and the appropriate entry has been made for TEST FREQ (Hz).

Following the individual menu entries, the RESONANT DWELL - LEVEL SCHEDULE is identical to that in Fig. 9-7. HELP pages are also available by pushing (Shift, ?), but are not shown here.

Following the completion of either resonant dwell SINE TEST SETUP in Section 9.4 or 9.5, press (F10) to save the SETUP and return to the SINE TEST SETUP Menu.

Fig.9-8

```
                                SINE TEST SETUP

 SETUP ID : RESDWEL2
                                                    current date : 08/14/89
                                                                 : 08:33:24
                                                    last updated : 08/09/89
                                                                 : 15:02:57

 TEST DESCRIPTION : RESONANCE DWELL AT 710 Hz


 TEST TYPE : ..................>4
   <1=LOG SWEEP, 2=LINEAR SWEEP, 3=DISCRETE FREQUENCIES, 4=RESONANT DWELL>

 INPUT SENSITIVITY : ...........>1
   <1=10mV/g, 2=100mV/g, 3=1000mV/g>

 TEST FREQ (Hz) : .............>710

 LOWER FREQUENCY LIMIT (Hz) : ..>650

 UPPER FREQUENCY LIMIT (Hz) : ..>750

 AUTOMATIC RESONANT SEARCH : ...>N
   <Y=YES, N=NO>

 AMPLITUDE (LEVEL) CONTROL CHAN:>2

 PHASE CONTROL CHANNEL <1-8> ...>2

 FULL TEST LEVEL (0 dB) (g) : ..>10

 RESONANT DWELL DURATION TYPE : >1
   <1=TIME LIMIT, 2=NUMBER OF CYCLES, 3=KILOCYCLES, 4=MEGACYCLES>

 DISPLAY DATA AUTOMATICALLY? : .>2
   <1=END OF TEST, 2=END OF EACH LEVEL, 3=PERIODICALLY, 4=NO>

  SETUP ID : RESDWEL2   RESONANT DWELL - LEVEL SCHEDULE

-------------------------------------------------------------------------------
STEP      LEVEL          DURATION       ALARM      ABORT      PERFORM STEPS
 NO. (-dB REL TO REF) Hours Min Sec   (+%) (-%) (+%) (-%)    From To Times
-------------------------------------------------------------------------------
  1        0                 15    40   30   60   50
  2       10                 15    40   30   60   50
  3       20                 15    40   30   60   50
  4       10                 15    40   30   60   50
  5        0                 15    40   30   60   50
  6       20                 15    40   30   60   50      1    6    5
     ---------------------------------------------------------------
```

9.6 Performing the Resonant Dwell Test

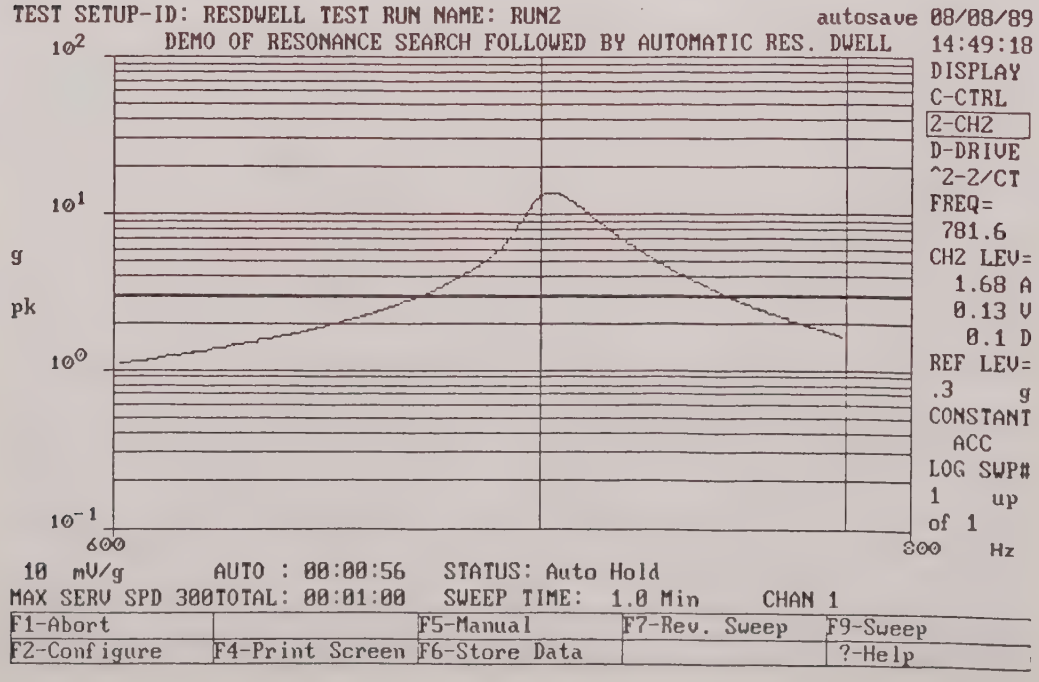
With the actual test system described in Section 9.4, (F7) was pressed to initiate the test. The queries below the SINE TEST SETUP Menu shown in Fig. 9-9 appeared. The default entries "RESDWELL" and "RUN2" were entered and "2" was entered in place of the default entry "4" for the query SAVE DATA AUTOMATICALLY. This allows a demonstration of the data saving format, described in Section 9.7.

In a few seconds a blank test graph appeared, and (F3-Auto) was pressed to initiate the sweep from 600 to 800 Hz. Near the end of the sweep, after (2) was pressed to display Channel 2, the display appeared as shown in Fig. 9-10.

Fig.9-9

```
                        SINE TEST SETUP

F1 = CREATE/EDIT                        F2 = RENAME

F3 = DISPLAY                            F4 = DISPLAY TEST SETUP LIST

F5 = PRINT                              F6 = PRINT TEST SETUP LIST

F7 = RUN TEST                           F8 = DELETE

F9 = COPY                               F10 = EXIT TO PREVIOUS MENU

RUN TEST SETUP-ID.............: RESDWELL
ENTER RUN NAME................: RUN2
SAVE DATA AUTOMATICALLY?......: 2
     <1=END OF TEST,2=END OF EACH LEVEL,3=PERIODICALLY,4=NO>

     Esc (Back to Menu)      Enter (Accepts Entry)
```

Fig.9-10



At the end of the sweep, or if (F7-Rev. Sweep) is pressed, a software routine detects the peak response frequencies that fall above the RATIO entry for the TEST SETUP shown in Fig. 9-3. The ratio level is also shown in the graph in Fig. 9-10. The frequencies corresponding to the half power points (.707 x peak response) are also detected, in order to estimate the Q for each detected resonance.

If more than one resonance is detected, the test is terminated at the end of the sweep with an appropriate message for the STATUS. The resonances may then be listed on the line printer by pressing (F9). However, for the case shown only one resonance was detected and the numerical values for Q and resonance frequency were flashed momentarily after the sweep was completed.

Following the completed sweep the blank graph shown in Fig. 9-11 was displayed. The AUTO mode was immediately established. In the AUTO mode the phase reference is automatically established at the resonant frequency and the first test level in the LEVEL SCHEDULE, in this case at 0 dB = 10 g. The phase sensitivity and polarity are also automatically determined by varying the frequency from the resonant frequency and keeping the phase reference fixed. Folling these measurements the gain and sense of the phase loop is automatically set and the phase loop is closed, thus beginning the test time for STEP No. 1 of the LEVEL SCHEDULE. During this measurement and adjustment period, the STATUS: indicates "Ramping".

In the actual test, after 11 seconds of AUTO test at 0 dB, (F5) was pressed, putting the system in the MANUAL mode. Fig. 9-11 actually was displayed after this operation. Shown in Figs. 9-12 through 9-15 are the HELP pages which are available during the test. These explain the action of the FUNCTION KEYS and the other keys used for special purposes. Note that some of the keys are active only in the MANUAL mode.

Fig.9-11

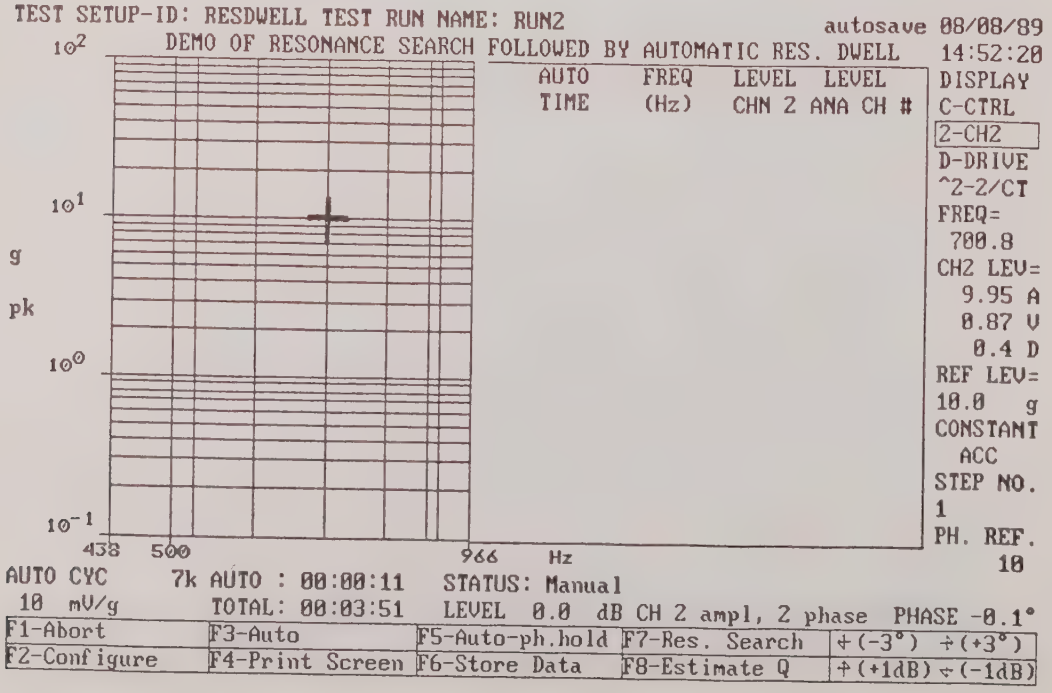


Fig.9-12

RESONANT DWELL TEST RUN

Access to most of the function keys described below can be controlled through the OPERATOR ACCESS selections in the MAINTENANCE/CONFIGURATION menu.

F1 - ABORT - When in the Auto, or Manual modes, this stops the test by compressing the drive output at the maximum possible speed without generating any high frequency transients.

F2 - CONFIGURE - Provides a menu which enables the operator to change the manner in which the graph is displayed.

F3 - AUTO - Initiates automatic level changes as specified in the setup. If pressed after an abort, it will resume at the level where it stopped. If pressed during manual, it will control to the original frequency (phase reference) that was set at the start of the test or by F7-RES SEARCH.

F4 - PRINT SCREEN - Causes the current display to be printed on the printer.

F1 - Abort F4 - Print Screen PgDn - next page Esc - back to graph

Fig.9-13

RESONANT DWELL TEST RUN

F5 - MANUAL - Enters the Manual mode, in which frequency (phase reference) and level may be controlled by the cursor keys.

OR

F5 - AUTO (PH. HOLD) - Enters the Auto mode from the Manual mode and holds the phase reference at the current value. This differs from F3 - AUTO only if the phase reference was last changed by use of the horizontal arrow keys.

F6 - STORE DATA - Saves immediate numerical data on the hard disk, in addition to the data stored automatically by request at entry to the TEST RUN.

F7 - RES SEARCH - Automatically generates a routine (Manual mode only) which resets the phase reference and shifts the test frequency to a point of maximum phase slope.

F1-Abort F4-Print Screen PgUp-previous page PgDn-next page Esc-back to graph

Fig.9-14

RESONANT DWELL TEST RUN

F8 - ESTIMATE Q - Automatically generates a routine (Manual mode only) which shifts the phase reference 22.5° on both sides of the operating value, measures the frequency shifts, and displays the results of a calculation for Q. If data is being stored automatically, the Q value and other data at this time will be stored.

OR

F8 - LEAVE SEQ - Returns to the SINE VIBRATION TEST MENU without performing the remaining tests in the sequence.

F10 - LEAVE TEST - Returns to the SINE VIBRATION TEST MENU, or performs the next test in the sequence.

INS - ANNOTATE - Enter the Annotate mode to permit the operator to put text on the graph.

C-CTRL - Press C to display graph for the control channel.

D-DRIVE - Press D to display graph for the drive voltage.

F1-Abort F4-Print Screen PgUp-previous page PgDn-next page Esc-back to graph

Fig.9-15

RESONANT DWELL TEST RUN

n-CHn - Press 1 through 8 to display graph and data for the corresponding anaylsis channel, if amplitude and phase control are derived from the same channel. Only amplitude and phase control channels may be shown if these are different.

^n-n/CT - Press Alt and 1 through 8 simultaneously to display graph of response ratio for the specified analysis channel to the control channel. The same restrictions on changing channels as for n-CHn apply.

<- -> - Active in the Manual mode, and causes the phase reference to shift by 1 bit (2.8°) and cause an accompanying change of frequency. At a resonance frequency a shift of 16 bits (45°) in either direction causes the frequency to change approximately one half the resonance bandwidth.

↑ ↓ - In Manual mode, raises or lowers the level by .1 dB. Pressing the shift key at the same time will raise or lower the level by 1 dB.

F1 - Abort F4 - Print Screen PgUp - previous page Esc - back to graph

While the system was in the MANUAL mode, the Q was estimated twice by pressing (F8). Fig. 9-16 shows the display immediately following the second measurement. The value for Q (= 9.6) is shown in the upper right-hand corner of the graph. The analysis channel had also been changed to Channel 1. The two Q measurements are also saved with other data after the measurement is made, if one of the data save options is selected when entering the TEST RUN (See Fig. 9-9).

Since the value for Q is suspected to be low (F7) was pressed to initiate a resonance search. Following this, which caused the PHASE REFERENCE to be reset from 10 to 26 (See lower right-hand corner of the display), (F8) was again pressed to yield a measured Q of 38.7 as shown in Fig. 9-17. Note that the test frequency has shifted from 700.9 Hz to 711.3 Hz.

Additional Q measurements were made later in the test at test levels of -10 dB and -20 dB. The results are not shown here but will be shown in Section 9.7, which describes the saved data.

Finally, when the AUTO test had completed all the steps indicated in the LEVEL SCHEDULE table, including the repetitions described by the looping statements, the display shown in Fig. 9-18 appeared. Note that the last 16 data displays are displayed in the right-hand table. This is always the situation at any point during the test. This feature allows the test engineer to obtain an instant report of what has transpired over several minutes, hours or even days, depending upon the frequency of the data displays.

Note that the levels reported for Channel 1 appear to be the same for -10 dB and -20 dB (0.10 g). This happened because the maximum value for the analog detector for the analysis channels was defaulted at 1000 g. If (F2) had been pressed at the beginning of the test, the analysis channel maximum value could have been set at 10 g to realize more accurate values for these low values.

Fig.9-16

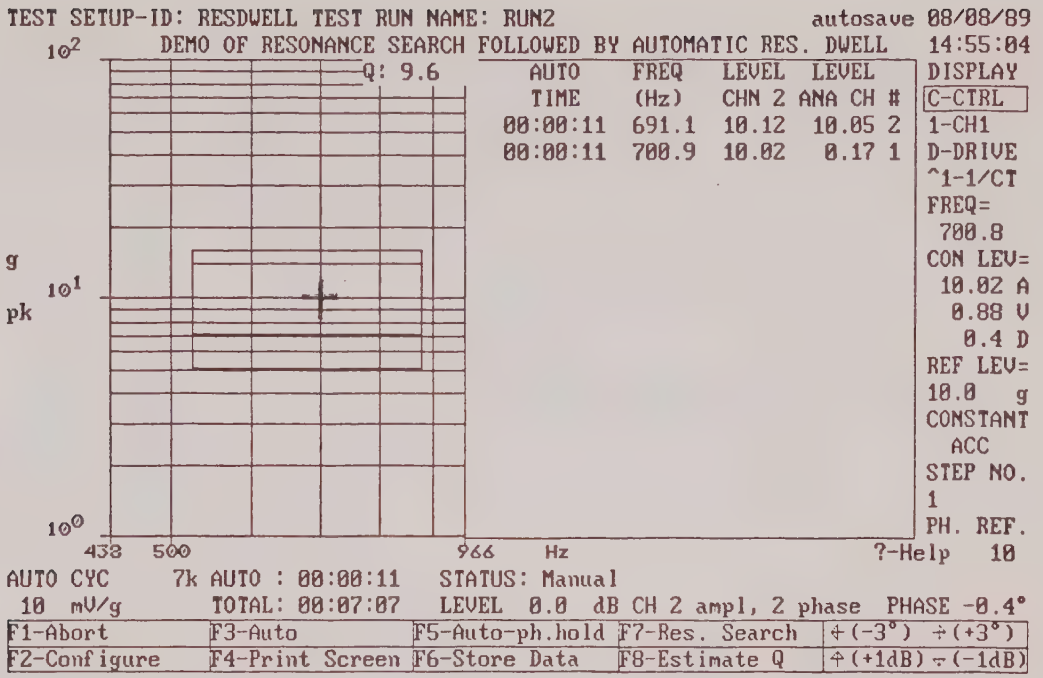
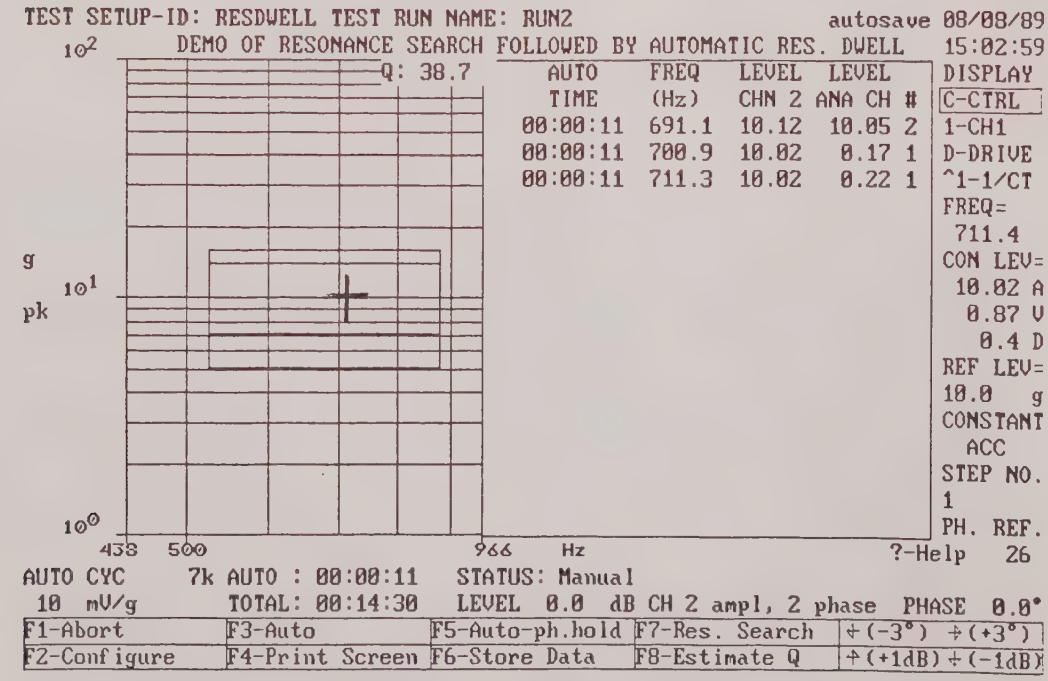


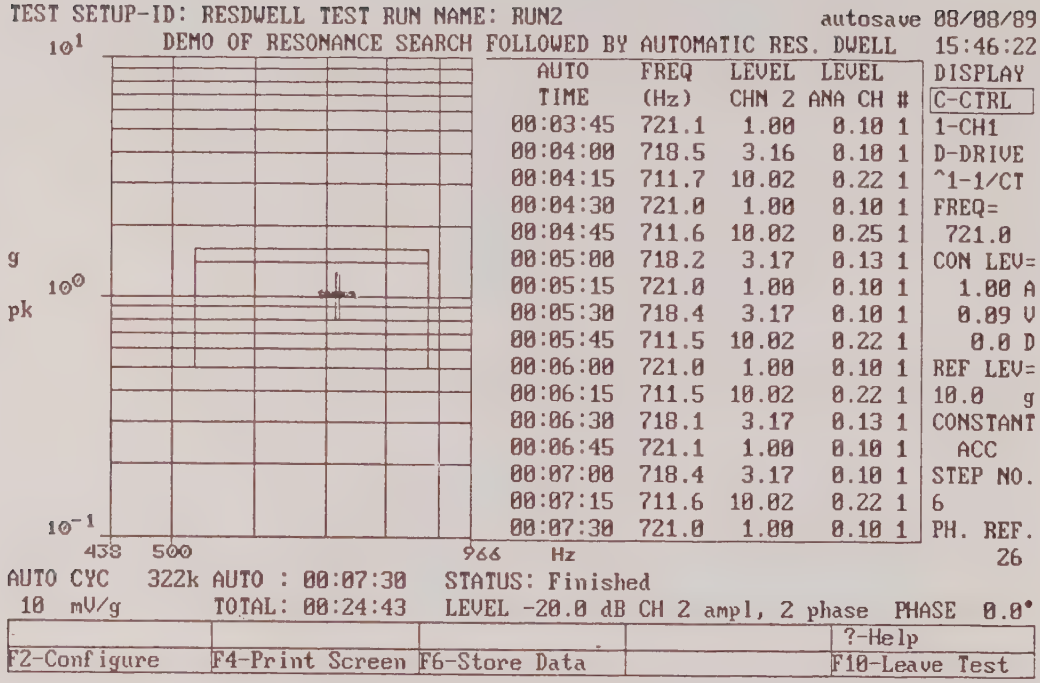
Fig.9-17



Finally (F10) was pressed to exit the test and return to the SINE TEST SETUP Menu.

Before investigating the format for saved data in Section 9.7, several more comments concerning operations during testing should be made.

Fig.9-18



If a resonant dwell test is made without the initial sweep, the operator has a choice to begin the test in either the AUTO mode or MANUAL mode. Using the AUTO mode, the initial automatic setup procedures for setting the phase reference and the closed loop gain are accomplished at the amplitude level specified by STEP No. 1 in the LEVEL SCHEDULE. Using the MANUAL mode, the same setup procedures occur, but at -20 dB relative to the full test level.

After entering the MANUAL mode from the AUTO mode furing the test, the test level may be varied anywhere between -20 dB and 0 dB in 0.1 dB increments. However, when reentering the AUTO mode, the test resumed at the location in the LEVEL SCHEDULE Table where the AUTO mode was discontinued earlier. However, any changes in the phase reference may or may not be kept, depending on whether (F3) or (F5) is used to reenter the AUTO mode and whether (F7) has been used for a resonance search during the MANUAL mode.

If the test is aborted by pressing (F1), it may be resumed by either pressing (F3-Auto) or (F5-Manual). After the initial setup procedure, the AUTO mode will be resumed at the location in the LEVEL SCHEDULE where the abort command was given, or in the MANUAL mode at a level of -20 dB.

9.7 Saving and Retrieving Data

As explained in Section 9.6, data is saved automatically by entering the appropriate response to the last query that appears after pressing (F7-Run Test). See Fig. 9-9. Also, as indicated by the HELP page in Fig. 9-13, data is also saved at any time during the test by pressing (F6).

Retrieving the data stored on the hard disk is accomplished by the procedures explained in Section 5.3. The format of the saved data for the resonant dwell test is different from that for a sweep sine test and is illustrated in this section.

After pressing (F3) when the SINE TEST DATA Menu is shown, RESDWELL and RUN2 were entered or confirmed in response to the requests DISPLAY TEST SETUP ID: and ENTER RUN NAME:. After a short wait the graph shown in Fig. 9-19 appeared after further pressing (2) so that Channel 2 would be shown. This graph summarizes the results at the end of the automatic sweep.

Pressing (F1) reveals the data summary shown in Fig. 9-20. The stored data is in a similar format to that displayed during the test except that it is more extensive and the graphical half of the test display is omitted. Figs. 9-21 and 9-22, which are obtained by pressing (F1) successively, show the remainder of the stored data.

Each set or page of stored data contains 16 individual sets of data stored in time sequence. The conditions shown on the original graph borders are those corresponding to the data set in the last row of the 16 displayed sets.

The presentation allows easy examination and presentation of fatigue phenomena, such as frequency shift, as the test progresses.

For this particular test, the resonance curve in Fig. 9-19 appears tilted to the left, and its asymmetry is suggestive of a nonlinear resonance with a "soft" spring (spring constant decreases with displacement). This is indeed the case, as the numerical data in Fig. 9-20 shows. The resonance frequency increases approximately 10 Hz as the test level decreases from 0 dB to -20 dB. The measured Q also increases from 38.7 to 51.1 over the same range of test levels.

Fig.9-19

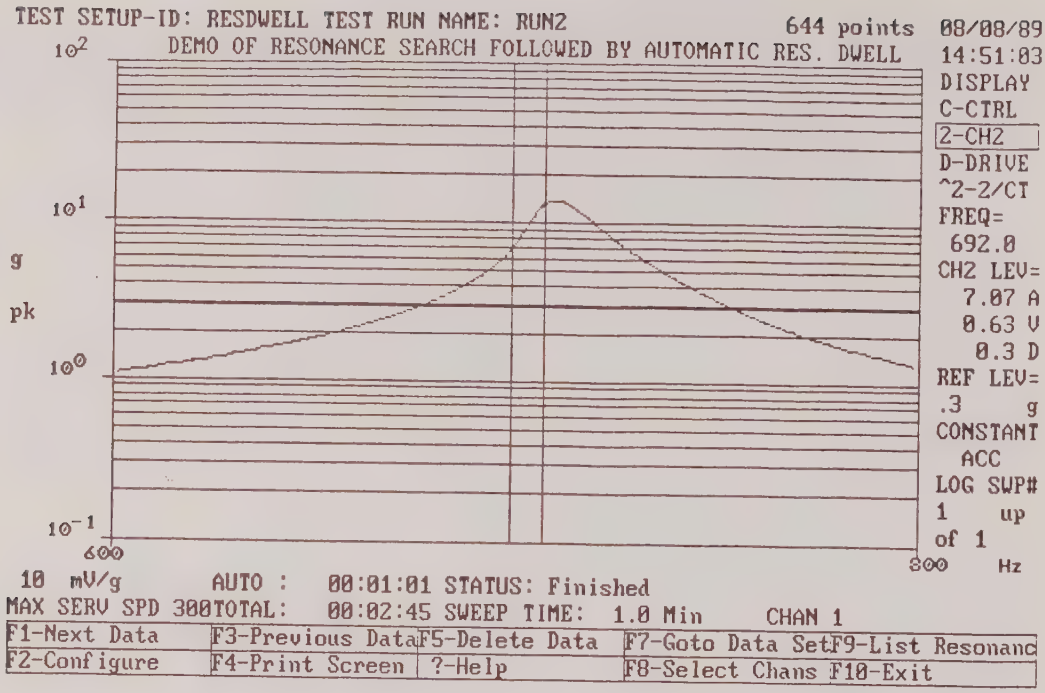


Fig.9-20

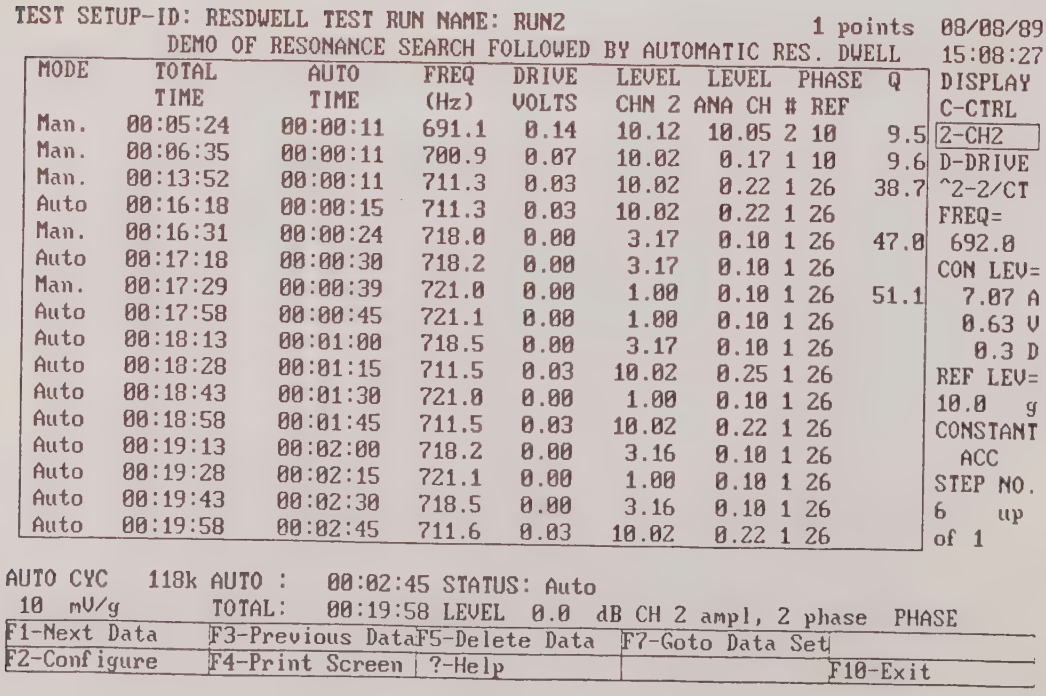


Fig.9-21

TEST SETUP-ID: RESDWELL TEST RUN NAME: RUN2 1 points 08/08/89
DEMO OF RESONANCE SEARCH FOLLOWED BY AUTOMATIC RES. DWELL 15:12:27

MODE	TOTAL TIME	AUTO TIME	FREQ (Hz)	DRIVE VOLTS	LEVEL CHN 2	LEVEL ANA CH	# REF	PHASE	Q
Auto	00:20:13	00:03:00	721.0	0.00	1.00	0.10	1	26	
Auto	00:20:28	00:03:15	711.5	0.03	10.02	0.22	1	26	
Auto	00:20:43	00:03:30	718.2	0.00	3.17	0.10	1	26	
Auto	00:20:58	00:03:45	721.1	0.00	1.00	0.10	1	26	
Auto	00:21:13	00:04:00	718.5	0.00	3.16	0.10	1	26	
Auto	00:21:28	00:04:15	711.7	0.03	10.02	0.22	1	26	
Auto	00:21:43	00:04:30	721.0	0.00	1.00	0.10	1	26	
Auto	00:21:58	00:04:45	711.6	0.03	10.02	0.25	1	26	
Auto	00:22:13	00:05:00	718.2	0.00	3.17	0.13	1	26	
Auto	00:22:28	00:05:15	721.0	0.00	1.00	0.10	1	26	
Auto	00:22:43	00:05:30	718.4	0.00	3.17	0.10	1	26	
Auto	00:22:58	00:05:45	711.5	0.03	10.02	0.22	1	26	
Auto	00:23:13	00:06:00	721.0	0.00	1.00	0.10	1	26	
Auto	00:23:28	00:06:15	711.5	0.03	10.02	0.22	1	26	
Auto	00:23:43	00:06:30	718.1	0.00	3.17	0.13	1	26	
Auto	00:23:58	00:06:45	721.1	0.00	1.00	0.10	1	26	

DISPLAY
C-CTRL
2-CH2
D-DRIVE
^2-2/CT
FREQ=
692.0
CON LEV=
7.07 A
0.63 V
0.3 D
REF LEV=
10.0 g
CONSTANT
ACC
STEP NO.
4 up
of 1

AUTO CYC 290k AUTO : 00:06:45 STATUS: Auto
10 mV/g TOTAL: 00:23:58 LEVEL -20.0 dB CH 2 ampl, 2 phase PHASE

F1-Next Data	F3-Previous Data	F5-Delete Data	F7-Goto Data Set
F2-Configure	F4-Print Screen	?-Help	F10-Exit

Fig.9-22

TEST SETUP-ID: RESDWELL TEST RUN NAME: RUN2 1 points 08/08/89
DEMO OF RESONANCE SEARCH FOLLOWED BY AUTOMATIC RES. DWELL 15:13:12

MODE	TOTAL TIME	AUTO TIME	FREQ (Hz)	DRIVE VOLTS	LEVEL CHN 2	LEVEL ANA CH	# REF	PHASE	Q
Auto	00:24:13	00:07:00	718.4	0.00	3.17	0.10	1	26	
Auto	00:24:13	00:07:00	718.4	0.00	3.17	0.10	1	26	
Auto	00:24:28	00:07:15	711.6	0.03	10.02	0.22	1	26	
Done	00:24:43	00:07:30	721.0	0.00	1.00	0.10	1	26	

DISPLAY
C-CTRL
2-CH2
D-DRIVE
^2-2/CT
FREQ=
692.0
CON LEV=
7.07 A
0.63 V
0.3 D
REF LEV=
10.0 g
CONSTANT
ACC
STEP NO.
6 up
of 1

AUTO CYC 322k AUTO : 00:07:30 STATUS: Finished
10 mV/g TOTAL: 00:24:43 LEVEL -20.0 dB CH 2 ampl, 2 phase PHASE

F1-Next Data	F3-Previous Data	F5-Delete Data	F7-Goto Data Set
F2-Configure	F4-Print Screen	?-Help	F10-Exit

9.8 Specifications - Resonant Dwell - Model UD345

Frequency Range: 5 to 5000 Hz

Frequency Measurement/Display Accuracy: ±0.1 Hz or ±0.2% whichever is smaller

Frequency Resolution at Setup:

.0017f (f≤750, f>750 and Q<f/50), or 1.2 Hz (f>750 and Q≥f/50)

Max. Q (Relative damping = 1/(2Q)):

3f	(5 < f < 83 Hz)
250	(83≤ f ≤ 750 Hz)
3 to f/3	(750 ≤ f ≤ 3000 Hz)
1000	(3000 ≤ f ≤ 5000 Hz)

Reference Phase Range/Resolution: 180° in 64 steps - 2.8° res. automatically or manually selected.

Phase Loop Response Time: Approx. 1 s. (Q>6). Automatically set at beginning of resonant dwell test.

Frequency Abort Limits

High: test frequency +1% to 5000 Hz
Low: test frequency -1% to 5 Hz

Amplitude Control Alarm/Abort Limits

Alarm:	Test level + 5% to + 999%
	Test level - 5% to - 99%
Abort:	Test level + 10% to + 999%
	Test level - 10% to - 99%

CONTROL/MONITOR CHANNELS: When amplitude and phase control are obtained from the same channel, the monitor channel may be changed by keystroke to receive data from any channel. If amplitude and phase control are obtained from different channels, the monitor channel is used for phase control and cannot be changed during the test.

AUTOMATIC TEST LEVEL SCHEDULE:

Amplitude:	-20.0 dB to 0.0 dB (full test level) in increments of 0.1 dB
Duration:	9999 hrs. or 10^{11} cycles max. for each level.
Test Levels:	At least 16 different test levels with nested loops for repetition.

Manual Mode:

Amplitude: -20.0 dB to 0.0 dB (full test level) in increments of 0.1 or 1.0 dB controlled by up/down arrow keys.

Phase Reference: 180° range in increments of $\pm 2.8^{\circ}$ controlled by right/left arrow keys.

TESTING FORMATS: Sweep search for resonance, followed by resonant dwell

DATA DISPLAY: Automatic display selectable for equal time or cycle intervals, at the end of each test level or at the end of test in AUTO mode. Keyboard command for additional displays at any time. The most recent 16 data displays are shown on Video Monitor. Data displayed is: Time (cycles); Test frequency; Vibration level of phase-controlled channel; Monitor channel level; Monitor channel No.

OTHER DISPLAY INFORMATION: Around the border of the video display, the following information is shown: TEST SETUP ID; TEST RUN NAME; test description (60 characters); date; time; graphical display variable (control channel; monitor channel; drive voltage; transfer function); frequency; control level (A, V and D); reference level; Step No. (in auto LEVEL SCHEDULE); input acceleration sensitivity; total cycles; total time; auto test time; system status; test level (dB); amplitude control channel; phase control channel; phase indication, phase reference.

DATA STORAGE: Data storage on the hard disk may be selected when the test is initiated. Data is stored in a columnar fashion for all the autoatic data display times, as well as when key commands for data display are made, and also when key commands to determine Q are made. Columnar data stored are: Test Mode; Total Test Time (cycles);Auto Test Time (cycles); Frequency; Drive Voltage; Amplitude control channel level; Phase control channel level; Monitor channel level (when phase control channel is same as the amplitude control channel); Monitor Channel No; Q (when commanded). This data may be scrolled on the Video Monitor by command when recalled, and printed out by command. Also stored is the graphical display at the end of the initial sweep search.

10. CIRCUIT DESCRIPTION

The operation and signal flow of the UD345 are briefly described in Sections 1.2 and 1.3. The circuit card connection schematic is found in Fig. 8.1 and detailed circuit diagrams/layouts for each card are found in Figs. 8.2 through 8.43. The function of each card is briefly described in this chapter.

10.1 DAS-DAO - Interface - As the name implies, this card provides interface buffers, latches, logic, CMOS range switches, and MDAC's beteween the DASCON 1 card and the analog circuits of the UD345. U1 selects the control variable (A,V,D), U3 provides decade range switching of the control signal for the meter and control circuitry and U6 provides the fine gain adjustment for the control signal. The associated latches provide the switching necessary to establish the desired program segments.

Range switching for Servo Speed control is provided by U31. The fine gain control for determining sweep time/sweep speed is provided by U28.

Other functions such as mode control are provided by digital signals.

10.2 DB - Eight Channel Multiplexer - provides the multiplexer U13 and the memory U3 for proper sequencing of the eight possible input signals for average control. A 5-30 Hz bandpass filter (U5, U9) is included for processing low-level (<1g - pk), low frequency (<30 Hz) signals (single channel control) for display purposes.

10.3 DC - Eight Channel Monitor - provides the switch U13 for selecting the monitor channel given by keyboard command. A bandpass filter identical to that on the DB card is also provided by U5 and U9.

10.4 DD - Tri AC-DC Converter - contains three identical channels of AC-DC converters with three-pole filtering (U2, U6 - U3, U7 - U4, U8), each preceded by a controlled CMOS range-switch (U11-U13 - U14). Each input is fed by the acceleration control signal and the active range of each is

Channel 1	<1g, <30 Hz		<10g, <30 Hz
Channel 2	1g to 10g	OR	10g to 100g
Channel 3	10g to 100g		100g to 1000g

The selection of either set of choices above is determined by the maximum acceleration value in the Test Setup. The selection of the DC output provided by switch U12 follows the level table above and allows maximum accuracy for displaying vibration levels on the Video Monitor.

10.5 DE - Tri AC-DC Converter - provides exactly the same function as DD but the input signal is the acceleration signal for the monitor channel.

10.6 SA - Charge Amplifier - Integrators - contains the charge converter, Z2, the input sensitivity normalizer and three-pole low pass filter, Z3. The velocity and displacement integrators for the control signal are Z5 and Z7.

10.7 SB - AGC Control Card - contains a two-pole tracking high-pass filter (Z9 and Z1) which is controlled by the LIN FREQ signal, and is used to filter the velocity and displacement control signals from SA. The -3dB frequency is approximately 1/3 the operating frequency and the response is unity at the operating frequency. The low frequency noise is greatly reduced and makes possible the control of low velocities and displacements at high frequencies without stability problems.

The vibration control signal is full wave rectified and compared to the reference (Z3, Z4). The LOG FREQ signal is used to control the resistance of two EVR's (V5, V7). The first, V5, is used as a prefilter to prevent drive signal distortion under closed-loop conditions. The second, V7, determines the servo speed and the closed-loop time constant directly (See 7.11.3, 7.13.3). Switches Z7 and Z8 provide control for the AUTO/MAN, ABORT and LOCAL modes.

10.8 SC - AGC Amplifier - contains the integrator Z3, which accepts the drive current from SB-V7. The integrator output voltages controls the gain of the AGC amplifier (Z8, Z4, Z3). Gain in dB is a linear function of the integrator output voltage. The temperature of Z8 is controlled by Z7 for amplitude stability.

The amplifier (Z1, Z2) accepting the oscillator section output predistorts this signal at the input to the AGC amplifier so that the output of Z3 has extremely low distortion.

Switches (Z6) provide mode control.

10.9 DF - Local/Keyboard/Meter - provides AC-DC conversion and three pole filtering (U7) of the control signal for input to the Digital Vibration Meter VM, processes the PHASE signal through U6 to feed to the DASCON 1 card (RD option only), provides an AC to RMS DC conversion with two-pole filtering (U2) of the drive voltage to feed to the DASCON 1 card, provides a logarithmic output for the DRIVE VOLTAGE (dB) bar indicator, and provides switching functions for the LOCAL and KEYBOARD Modes (U3, U4, U5).

10.10 SE - Mode Control - contains logic and flip-flops necessary to control the CMOS switches on other cards and to operate the mode indicator LED's.

10.11 OS - Oscillator Mode Control - contains logic, flip-flops, and CMOS switches necessary for accepting logic inputs and providing means for sweeping the oscillator, holding the frequency constant, manually controlling the frequency, and resetting the frequency to the upper or lower limit.

10.12 OA - Sweep Light Control - contains the slip-flop for HOLD mode control and drivers for the UP, DOWN and HOLD LED's.

10.13 OC - Sweep Speed Control - generates a symmetrical square wave drive current. The magnitude of the drive current is determined by the MDAC-controlled amplifier on DAS-DAO, and is the correct value for providing the sweep time/speed specified in the test setup. A logic signal applied to Z3 reverses the drive current.

10.14 OD - Sweep Generator - accepts the drive current from OC and integrates it (Z1) to produce a symmetrical triangular wave voltage at OD-15. The upper and lower limit comparators (Z2, Z3) are used to reverse the sweep direction, as does the logic signal from the REVERSE flip-flop Z4.

10.15 OE - Log Converter - High Frequency Generator - actually contains an anti-log converter, Z3, which produces the log-sweep at OE-21. CMOS switch, Z4, provides selective feedback to provide both logarithmic and linear sweeps at OE-21. Regulator Z9 provides a precision 10.06 V reference source for the circuit.

The high frequency generator, Z8, is a precision V-F converter controlled by the sweep voltage at OE-21. Pulses at 128 times the operating frequency (128F) are produced at OE-19.

10.16 OG - Frequency Divides - Counter Control - receives the 128F pulse train from OE and provides 32F, 2F and 1F square waves for the OI card. The 32F train is also divided into an irregularly spaced 10F pulse train which is used to provide the frequency display on FM.

Control for the frequency meter (FM) is also provided. The power frequency is divided to provide a gate of 0.1 sec to count the 10F pulses.

Counting of the 128F pulses by U8 and U11 over the 0.1s gate interval also provides a 16-bit measurement of the frequency which is sent to the Host by means of the DASCON card over a 8-bit data bus in two bytes. This provides a maximum frequency reading of 5120 Hz with a LSB resolution of 0.08 Hz.

10.17 OI - Sine Generator - contains an eight-bit reversible shift register (Z1, Z3), eight current switches (Z2, Z4), and a signal inverter (Z5, Z6) to produce a stairstep sine wave at OI-19.

The shift register shifts at the 32F rate. The reversing of the direction of the shift register is controlled by the 2F signal, each direction producing 90° (one quarter) of the sine wave signal. The 1F square wave provides the signal inversion through Z7 necessary to provide the negative portion of the sine wave.

Harmonic distortion is approximately 4% with mostly 31st and 33rd harmonics.

10.18 ON - Tracking Low-Pass Filter - filters the high frequency harmonics at the output of OI. Two separate two-pole filters are provided. The variable cutoff frequency is produced by using matched EVR's (V1 through V5). The EVR's are controlled by the LIN FREQ input (ON-20) for resistance inversely proportional to frequency.

10.19 DG - S/R Selector is controlled by logic signals to select the RANDOM DRIVE OUT signal from the UD320 (Random Testing), the SINE DRIVE out signal from the UD345 (Sine Testing), or the sum of these two signals (SOR Testing) and route the selected signal to the S/R DRIVE OUT connector on the UD345. The RANDOM DRIVE OUT signal is selected if AC power to the UD345 is off.

Multiplexer logic to the card supplies the correct LIN FREQ signal for the AM123 when average testing is used.

10.20 CS - Chip Select - adds to the capability of the OAS-040 card and allows addressing for reading or writing to as many as 16 additional registers on the 8-bit data bus. Currently three registers are being addressed: OG card (2 bytes) and RD card (one byte).

10.21 DH - Decimal Point Select - allows the Host to set the decimal point on the front panel vibration meter, VM, and also to light the "MILLI" front panel LED when necessary, thus allowing another 3 decades of display values.

10.22 RD - Resonant Dwell (Option) - allows resonant dwell testing by controlling the test frequency to maintain constant phase between the vibration signal of the resonant item and the oscillator drive signal. A 6-bit reference phase input is written from the data bus to U4 via U7. A phase-shifted version of the 1F waveform appearing at U2-2 is found at U2-5. This phase lag is adjustable between 0 and 180^{o} in 64 (6-bits) equal steps. U6 and U5 serve as a clipper for either the monitor channel signal or the amplitude control channel signal. The phase-shifted reference signal and the clipped vibration signal are digitally multiplied by two exclusive - OR circuits (U3) and the result is low-pass filtered by U1. This latter combination provides the phase detector, the output of which is fed via RD-7 to OC and then to OD, which provides control of the operating frequency.

MP MASTER

MA31552

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